

Appendix C

Princeville, North Carolina Flood Risk Management Integrated Feasibility Report and Environmental Assessment Geotechnical Engineering

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1. Purpose

The purpose of the Feasibility Study for the Princeville Flood Risk Management project is to assess the flooding problems in the Town of Princeville, and address associated flood risk alternatives for the town, as well as reduce flood risk for the Town of Princeville to the minimum level intended by the authorized Section 205 project. The present project has gaps (low elevation areas) that permit flood waters at elevations below the 1% (0.01 probability of exceedance) flood level to inundate portions of Princeville that were intended to be protected by the original project.

The purpose of the Geotechnical Appendix is to present the results of the subsurface investigations and required analyses using current levee criteria (U.S. Army Corps of Engineers Engineering Manual (EM) 1110-2-1913), as well as to reflect the determination of geotechnical requirements for a plan to reduce flood risk to the Town of Princeville.

2. General

The existing levee system is located on the western, southwestern, and northern sides of the Town of Princeville and was constructed in 1964 by the US Army Corps of Engineers. The existing levees are constructed of sandy soils with side slopes at 3H to 1V on the riverside and 2.5 H to 1V on the landside. The levee system's purpose is to provide Princeville with protection from flooding by the Tar River. It was overtopped by flooding associated with Hurricane Floyd in 1999. Water also flowed around the northern and southern ends of the levee causing millions of dollars in damages. Additionally, several locations along the levee were damaged by erosion due to overtopping, as shown in Figure 1. Damaged areas of the levee were repaired to a condition similar to that of the pre-flood condition. This study identifies alternatives that would provide Princeville flood protection with a minimum of a 77% chance of not being exceeded by the 1% annual flood event. The Tentatively Selected Plan (TSP) will require the addition of flap gates at ungated culverts at twelve (12) locations, addressing a low spot in the existing embankment height of U.S. Highway 64, addressing the existing U.S. Highway 33 underpass through which flood flows can enter the Town, and construction of levee segments along specific locations along Highway 258, NC-111, and Shiloh Farms Road, to prevent overtopping. It will also include interior drainage features, and non-structural measures to maximize flood risk reduction. Several alternatives for these revisions are identified in this Feasibility Report. The final plan will be evaluated using additional subsurface investigations, slope stability analyses, and the seepage analyses during the Pre-Construction, Engineering, and Design (PED) phase.

Both the existing and proposed project incorporate portions of the US Highway 64 embankment as part of the flood damage reduction system. The highway embankment performed well during the Hurricane Floyd flood event. Although overtopping occurred along a portion of the Highway 64, the embankment was not breached. After Hurricane Floyd, the highway embankment required only minimal repairs to erosion by the North Carolina Department of Transportation (NCDOT). Although the US 64 highway embankment performed well, the Federal Department of Transportation (FDOT) and Federal Highway Administration (FHWA) have determined that any highway or railroad embankment incorporated into a flood reduction levee system must meet the same design requirements as other portions of the earth levee system. This decision is due to the recent poor performance of other highway embankments that serve as levees in the Midwest.

The earthen levee sections (non-highway) of the existing project were constructed in 1964. Currently, no original design calculations have been located. The original foundation and borrow area material information are available for this earth embankment flood reduction levee (CS-1 through CS-40, see Attachment 2); however, there are no as-built drawings or reports that indicate where the borrow source was located or what level of compaction was obtained during construction. Historically, the levee has performed well, though during Hurricane Floyd overtopping caused erosion at some locations due to the sandy material from which this levee was constructed.

3. Subsurface Investigation Methods

Subsurface investigative methods utilized conventional and widely accepted sampling practices. These methods include Standard Penetration Tests (SPT), Cone Penetration Tests (CPT), Direct Push sampling, and hand auger sampling techniques. Bulk samples were obtained from the borrow area by hand shovel. All samples were visually field classified in accordance with the Unified Soils Classification System (USCS) as required in the US Army Corps of Engineers (USACE) Manual 1110-1-1804.

The SPT is a widely accepted test method of *in situ* testing of foundation soils (ASTM D 1586). A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The test holes are advanced to the test depths by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, NX-size flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

The CPT is also a widely accepted test method of *in situ* testing of foundation soils (ASTM D 3441). An instrumented conical shaped probe (usually 10 to 15 centimeters in diameter) is pushed into a soil deposit at a controlled rate of 1 to 2 cm/sec. Output quantities for both sleeve friction and tip resistance are simultaneously recorded in units of tons per square foot per foot of depth. In addition, dissipation of excess pore water pressure or seismic shear wave velocities can be recorded at discrete depth locations. This testing method is useful in determining the delineation of soil stratigraphy.

Direct Push borings are taken with hydraulically powered equipment, which applies static and dynamic percussion forces to a soil probing hammer. The soil particles are rearranged by the application of weight and percussion to advance the probe further into the ground. Once the probe reaches the desired depth or refusal, the probe is removed and the sample is recovered in a plastic cylinder.

3.1 Previous Subsurface Investigations in 1964, 1965, & 2000

Several previous subsurface investigations were: (1) subsurface investigation performed by the Savannah District / Mobile Drill Crew in 1964; (2) a preliminary geotechnical investigation by Froehling and Robertson, Inc in 1965; and (3) an adjunct draft geotechnical report prepared by Titan Atlantic Group, Inc in 2000. All boring logs and lab data are included in Attachments 2

and 3, respectively. These reports describe subsurface soil conditions encountered during various field and laboratory investigations at locations along the existing levee and borrow areas. Previous field investigations/testing included drilling and SPT (ASTM D 1586), Soils Classification (ASTM D 2487), Grain Size Distribution (ASTM D 422), Standard Proctor (ASTM D 698), and Atterberg Limits (ASTM D 4318).

Thirty eight SPT borings were taken along the existing levee alignment by the Savannah District in 1964. See Figure 2 for the boring locations. The depth of these borings ranged between 20 and 30 feet below ground surface (BGS). Samples taken from these borings were visually classified in the field and no laboratory soil testing was performed. The types of soils encountered along the existing levee (Dike A, paralleling the Tar River) consisted primarily of clean and silty sands. Several of the borings revealed a layer of fat clay (CH) which was usually encountered between 10 to 20 feet BGS. The presence of CH material beneath a proposed embankment could be problematic for stability and settlement, however; the SPT blow count of nearly all of this clay was exceedingly high, (25 to 60) indicating that this material was very stiff and probably consolidated. No evidence of instability or settlement has been noted along the existing levee during Routine or Periodic Inspections.

Repairs were made in 2000 to the eroded areas of the levee by USACE (Figure 1). Four samples from the borrow area were sent to Froehling & Robertson, Inc. for testing. These include Gradation Size Distribution (ASTM D 422), Standard Proctor (ASTM D 698), Atterberg Limits (ASTM D 4318), Moisture Content (ASTM D 2216), and Soils Classification (ASTM D 2487). As part of the repair project, Titan Atlantic Group performed Field Density Tests (ASTM D 1556) as a back check of the repaired structural fill.

3.2 Recent Subsurface Investigations (2006 & 2009)

3.2.1 Levee Investigations

In 2006, the Wilmington District performed a subsurface investigation along the entire existing Princeville levee and the proposed extension of the levee to the northeast (Figure 2). A drill rig and crew from the Savannah District were utilized for this purpose. The drill rig could not access the proposed borrow area and changes were made to the tentatively selected plan after drilling operations were completed. As a result, complete subsurface investigation along the entire levee alignment was not accomplished and the resulting data do not include the entire tentatively selected plan (TSP).

Eleven SPT borings were taken along Section B and the proposed northeast extension. These range in depth from 15 to 31 feet BGS (Table 1). The boring logs show interbedded sand layers, consisting of silty sands, clayey sands and poorly graded sands. Fat clay (CH) was encountered 11 to 15 feet BGS at three locations (PFR-06-SS-13, PFR-06-SS-14, & PFR-06-SS-21). At the boring location PFR-06-SS-19, fat clay (CH) was encountered at 2 feet BGS.

Seven Direct Push borings were taken along Section B and the proposed northeast extension (PFR-06-GP-02, 03, 04, 05, 06, 15, & 16), four of which were taken in roadways, ranging in depth from 15.5 to 30 feet BGS (Table 1). The boring logs indicate a significant presence of poorly-graded sands, clayey sands and silty sands. Fine-grained soils, such as lean silts and sandy lean clays, were also encountered. Fat clay (CH) was encountered at two of these borings.

Four combination core/SPT borings were taken on Highway 258 and Shiloh Farm Road. The depths of these borings were approximately 3 to 4 feet BGS. A few inches of asphalt/concrete were cored and the underlying silty and clayey sands were sampled with a splitspoon.

Seven CPT's were performed to corroborate the SPT and Direct Push borings results. They appear to correlate well to the companion borings.

A field exploration program was conducted by the Wilmington District of USACE on April 14 - 18, 2009. Nineteen SPT holes were advanced to total depths ranging from 15 to 30 feet BGS. Eleven borings were drilled in the existing levee areas, three borings were drilled in the vicinity of Highway 64, and five borings were drilled in the newly proposed borrow area. See Figures 3 through 6 for the locations of the borings. Two hundred fifty samples obtained from the nineteen SPT borings were delivered by USACE to Ardaman & Associates, Inc. in Orlando, Florida for laboratory testing. In addition, three boxes of soil samples obtained from the proposed borrow area were also tested. Table 1 summarizes the field exploration conducted in 2009.

Based on the subsurface information, clean, pervious sands inter-bedded with layers of silty and clayey sands exist in the study area, especially in close proximity to the river. Further from the river, layers containing higher percentages of fine-grained soils may be expected. A moderately stiff layer of fat clay (CH) several feet beneath the surface is revealed in some of the borings and may be present beneath most of the study area. Correlation of subsurface layers from one boring to another is not readily apparent due to the inter-bedded nature of the river sediments. For seepage and stability analyses, assumed subsurface conditions were based on the nearest borings.

3.2.2 Borrow Area Investigation

In 2006, four hand auger borings (A-1 thru A-4) were taken adjacent to the proposed borrow area, a heavily wooded area on the southeastern side of town (Figure 2). These borings were intended to provide an indication of the types of soils that might exist inside the borrow area. The depth of these borings ranged from 5.0 to 7.5 feet BGS. The types of soils (SP/SM, SP, SC, CL, and SP/SC) found at these locations are considered suitable for levee construction. However, due to land ownership and sufficient quantity issues, the borrow area was not investigated further. A new borrow area was proposed and investigated in 2009.

In 2009, five SPT borings (PD-BP-BA-1 through PD-BP-BA-5) were taken in the newly proposed borrow area, located north of the intersection of US Highway 64 and County Road 1524. The proposed borrow area is approximately 5 miles east of Princeville at the Sauerborn Property (Figure 6). In addition to the SPT samples, three boxed samples were obtained from the borrow area and shipped for laboratory testing. The boxed samples were labeled Box 1, Box 2 and Box 3, respectively. Borings taken from the site indicated the water table is approximately eight feet BGS. Quantities of available suitable borrow material may be limited due to the depth of the water table. The available borrow material available for levee construction has not been quantified.

4. Laboratory Testing Results

4.1 Levee Index Testing Results

Visual classification of the 67 soil samples taken in 2009 was performed in accordance with ASTM Standard D 2488 on representative portions of each soil sample. Unified soil classification was performed on selected soil samples in accordance with ASTM D 2847.

Moisture content determinations were performed in accordance with ASTM Standard D 2216 on representative portions of selected soil samples oven dried at 110° C.

The particle size distributions of soils samples were determined using mechanical sieving test methods in general accordance with ASTM Standard D 422.

Liquid and plastic limit measurements were performed on soils samples in general accordance with ASTM Standard D 4318 (Method A).

Based on the results of boreholes PDP-BP-SS-5, PD-BP-SS-8 AND PD-BP-SS-11, the following are the range of soil and parameters for the encountered soils:

Soil Description: Loose sand (SP) to Clayey sand (SC)

Saturated Unit Weight (pcf): 120-125

Φ' (degrees): 28-30

Soil Description: Medium dense to dense silty sand (SM) to clayey sand (SC)

Saturated Unit Weight (pcf): 125-135

Φ' (degrees): 33-36

Soil Description: Stiff Clay

Saturated Unit Weight (pcf): 130-135

Cohesion (psf): 1000-2000

Based on the results of boreholes PD-BP-SS-3, PD-BP-SS-7 AND PD-BP-SS-10, the following are the range of soil and parameters for the encountered soils:

Soil Description: Stiff Clay

Saturated Unit Weight (pcf): 120-125

Cohesion (psf): 1000-2000

Soil Description: Medium dense to dense sand (SP), sand with clay (SP-SC), and clayey sand (SC)

Saturated Unit Weight (pcf): 120-125

Φ' (degrees): 31-35

Soil Description: Very loose to medium dense silty sand (SM) and clayey sand (SC)

Saturated Unit Weight (pcf): 120-135

Φ' (degrees): 29-35

Soil Description: Medium stiff to stiff clay (CL)

Saturated Unit Weight (pcf): 130-135

Cohesion (psf): 1000

Soil Description: Medium dense silty sand (SM), and clayey sand (SC)

Saturated Unit Weight (pcf): 125-135

Φ' (degrees): 31-34

Based on the results of boreholes PD-BP-SS-4, PD-BP-SS-6 AND PD-BP-SS-9, the following are the range of soil and parameters for the encountered soils:

Soil Description: Loose to medium dense silty sand (SM), and clayey sand (SC)
Saturated Unit Weight (pcf): 120-125
 Φ' (degrees): 30-34

Soil Description: Very loose to silty sand (SM), and clayey sand (SC)
Saturated Unit Weight (pcf): 120-125
 Φ' (degrees): 29-31

Soil Description: Very stiff clay
Saturated Unit Weight (pcf): 125-135
Cohesion (psf): 1000-2000

Based on the results of boreholes PD-BP-SS-1, PD-BP-SS-2, the following are the range of soil and parameters for the encountered soils:

Soil Description: Loose to medium dense clayey sands (SC)
Saturated Unit Weight (pcf): 115-120
 Φ' (degrees): 30-31

Soil Description: Loose to dense sands (SM), and clayey sands (SC)
Saturated Unit Weight (pcf): 120-125
 Φ' (degrees): 30-35

Soil Description: Loose to medium dense sands (SP) and sands with clay (SP- SC)
Saturated Unit Weight (pcf): 120-135
 Φ' (degrees): 30-32

Based on the results of boreholes PD-BP-64-1 through PD-BP-64-3 in the vicinity of US HIGHWAY 64, the following are the range of soil and parameters for the encountered soils:

Soil Description: Loose to medium dense silty sands (SM) and clayey sands (SC)
Saturated Unit Weight (pcf): 120-125
 Φ' (degrees): 30-33

Soil Description: Very loose to loose sands (SP)
Saturated Unit Weight (pcf): 115-120
 Φ' (degrees): 29-31

Soil Description: Medium dense to dense clayey sands (SC)
Saturated Unit Weight (pcf): 125-135
 Φ' (degrees): 31-35

Soil Description: Hard clay (CL)
Saturated Unit Weight (pcf): 124-135
Cohesion (psf): 4000-6000

Results of the laboratory testing are provided in Table 2 and Attachment 3, B-39.

4.2 Borrow Area Testing Results

Compaction tests were performed on samples from each of the three boxes using the Standard Proctor method in general accordance with ASTM Standard D 698. The results of the compaction tests are presented in Table 3.

Six constant-head permeability tests were performed in the laboratory on borrow area samples, two tests from each box. Prior to testing, the specimens were compacted in rubber molds to a dry density equivalent to or greater than 95 percent of the Standard Proctor dry density value obtained for each box sample during the compaction tests. Table 4 summarizes the results of the laboratory permeability tests.

A total of nine direct shear tests were performed on samples from the three boxes. Three tests were performed on samples from each box with varying normal stress. The direct shear tests were performed to determine the shear strength parameters, c' and ϕ' , of the samples. The results of the direct shear tests are presented in Table 5.

Based on the results of the borings, the following are the range of soil parameters for the encountered soils:

Soil Description: Very loose to loose sand (SP), sand with clay (SP-SC), silty sand (SM), and clayey sand (SC)

Moist Unit Weight (pcf): 103-107

Saturated Unit Weight (pcf): 115-120

Φ' (degrees): 29-30

Results of the laboratory testing are provided in Attachment 3.

5. Seepage Analysis

5.1 SEEP/W[®]

Steady-state seepage analysis was performed using GeoStudio's SEEP/W[®], a two dimensional finite element modeling program. Seepage analyses were performed to verify that the existing levee meets the current levee safety criteria with regard to seepage exit gradients. The phreatic surface and pore-pressure distribution was modeled for the 0.01 probability of exceedance (1% chance of exceedance) flood events within the levee. Levee cross sections were developed using subsurface data, 2001 breach repair as-builts and current Light Detecting and Ranging (LIDAR) data, then converted to finite element meshes. Hydraulic conductivity functions were defined, boundary conditions were applied, and seepage conditions were predicted for various riverside and landside water elevations.

SEEP/W[®] provides values for the resultant seepage gradients. However, it only provides gradient information across an individual element. The View Element Information is appropriate for evaluating exit gradients for the case when there is no surface blanket. If the soil profile can be idealized with a top blanket of uniform thickness overlying a foundation layer of uniform thickness and seepage flow is assumed to be horizontal in the foundation and vertical in the blanket, then simple blanket theory equations can be used. The provided design criteria for allowable seepage gradients of 0.3 and 0.8 were developed primarily for blanket materials with a unit weight of approximately 115 pounds per cubic foot (pcf), and that factors of safety for piping and uplift vary significantly depending on the unit weight of soils (Engineering Technical Letter (ETL) 1110-2-569). Determining gradients and factors of safety for piping and uplift are

different depending on whether or not there is a surface blanket of less pervious materials (clay, silt or peat) overlying more pervious materials (sand, gravel or pervious rock). EM 1110-2-1913 provides design criteria in terms of allowable seepage gradients.

5.2 Seepage Analysis Assumptions and Input Parameters

For the preliminary designs, the levee profiles were modeled from the 2001 Princeville Levee as-builts and current LIDAR data. The as-built drawings were from the 2000 Princeville Levee re-build after the Hurricane Floyd event damaged portions of the levee. Critical and non-critical sections of the levee were based on areas that were overtopped and damaged during the Hurricane Floyd flood event. Critical sections are areas where overtopping occurred. Non-critical sections are areas where no overtopping occurred (Figure 1).

The Princeville levee system, constructed with available material (SC or SP-SC) from local borrow areas, is considered to be an urban levee. Foundation assumptions are based on worst case scenarios from the available soil borings and lab testing data. Typical foundation geology is presented in Figure 8. It is assumed that the levee system is non-homogeneous, with a maximum height of approximately 9 ft. The crest of the levee system ranges from 9 to 12 feet wide. The seepage model follows steady-state conditions, with water surface elevations (headwater) at the crest of the levee system.

Four design profiles of the existing levee were created to analyze seepage and stability. The four profiles analyzed are listed below:

Station 32+00: Identified as a critical section, the levee is approximately 9 feet high with a top elevation of 49.0 feet. The levee has a 10-ft crest width. The side slopes for this section is 2.5 H to 1 V for the landside and 3.0 H to 1 V for the riverside. The riverside water elevation used in the analysis is 48 ft. The soil profile characteristics consist of loose clayey sand underlain by medium dense to dense poorly graded sand.

Station 38+00: Identified as a non-critical section, the levee is approximately 9 feet high with a top elevation of 49.0 feet. The levee has a 10-ft crest width. The side slopes for this section is 2.5 H to 1.0 V for the landside and 3.0 H to 1.0 V for the riverside. The soil profile characteristics consist of medium to dense poorly graded sand with clay, underlain by very loose to medium dense lean clay.

Station 40+00: Identified as a critical section, the levee is approximately 9 feet high with a top elevation of 49.0 feet. The levee has a 9-ft crest width. The side slopes for this section is 2.5 H to 1.0 V for the landside and 3.0 H to 1.0 V for the riverside. The soil profile characteristics consist of loose to medium clayey sand underlain by very loose to loose poorly graded sand.

Station 74+00: Identified as a critical section, the levee is approximately 15 feet high with a top elevation of 49.0 feet. The levee has a 10-ft crest width. The side slopes for this section is 2.5 H to 1.0 V for the landside and 3.0 H to 1.0 V for the riverside. The soil profile characteristics consist of loose to medium dense clayey sand underlain by loose to dense poorly graded sand sand.

SEEP/W[®] inputs consist of cross sectional geometry, hydraulic conductivity and boundary conditions for the flow domain. Output results from SEEP/W[®] consist of phreatic surface, head distribution, hydraulic gradient, flow directions and flow quantities within the flow domain.

Each soil layer was assigned a vertical permeability (k_v) value based on experience with soil types and laboratory permeability tests. The horizontal coefficient of permeability (k_h) of each layer was assumed to be one to two times the vertical permeability.

5.3 Seepage Analysis Results

As determined by Seep/W[®], the seepage pore water pressure within the levee was minor. The phreatic surface exits near the landside toe of the slope at lower storm events, and farther up the landside slope with higher storm events. The anticipated flood hydrograph was compared to the seepage analysis to evaluate responses to pore water pressure and propagation of water through the levee embankment. Lateral hydrostatic forces and seepage gradients within the levee and underlying foundation indicate the overall stability of the existing levee is acceptable. The results of the seepage analyses for each section are presented in Table 6 and Figures 9 through 12.

6. Stability Analyses

6.1 SLOPE/W[®]

Undrained slope stability analyses were performed using GeoStudio's SLOPE/W[®], a two dimensional finite element modeling program. SLOPE/W[®]'s formulation is based on the general limited equilibrium method, and uses an iteration scheme to find the critical slip surface and the corresponding minimum factor of safety. The factors of safety for circular modes of failure were calculated in the analyses. The method of analysis used to determine the factor of safety for Clouter Creek DA is Spencer's procedure (Spencer 1967, Wright 1970), which is the preferred method of the USACE, per EM 1110-2-1902 Engineering and Design – Slope Stability. Spencer's procedure fully satisfies static equilibrium for each slice within the failure area. The stability analyses were performed using the SLOPE/W[®] program with input from the SEEP/W[®] program and soil parameters from the 2009 subsurface investigation laboratory analysis.

Rapid drawdown slope stability analyses were also performed using Spencer's method in the GeoStudio's SLOPE/W[®]. Stability analysis during rapid drawdown is an important consideration in the design of embankment levees. During rapid drawdown, the stabilizing effect of the water on the upstream face is lost, but the pore-water pressures within the embankment may remain high. As a result, the stability of the upstream face of the levee can be much reduced.

6.1 Stability Analysis Results

The results of the steady seepage, undrained slope stability analyses for the existing levee cross sections are presented in Table 7 and Figures 13 through 16. The minimum factors of safety for the existing levee range from 1.50 to 1.79, which satisfies the minimum required factor of safety of 1.4 as per EM 1110-2-1913.

The results of the rapid drawdown slope stability analyses for the existing levee cross sections are presented in Table 7 and Figures 17 through 20. The minimum factors of safety for the existing levee range from 1.07 to 1.42, satisfying the minimum required safety factor of 1.0 for water levels unlikely to persist for a long period of time, as per EM 1110-2-1913.

7. Fragility Analysis

Seepage and stability analyses were performed using GeoStudio's SEEP/W[®] and SLOPE/W[®] programs. Utilizing previously identified critical sections, seepage and stability analyses were performed at four different locations along the levee alignment. Critical sections were defined as failure areas resulting from Hurricane Floyd in September 1999. These failures were a result

of backward erosion due to the overtopping of the levee. Modeled cross-sections were developed using subsurface data, the Princeville levee as-built drawings, and current LIDAR topographic surveys. The as-built data was from the 2000 Princeville levee repair for the damage sustained after Hurricane Floyd. The Princeville levee system was constructed with available materials from borrow sources, which were predominately silty and clayey sand (SC or SP-SC); soil parameters were based on laboratory analyses performed on the 2009 subsurface investigation laboratory analysis. Foundation assumptions are based on assumed worst case scenarios from the available soil borings and lab testing data.

The inputs used for generating the probability of failure $[Pr(f)]$ at different water elevations will be cross sectional geometry, hydraulic conductivity, undrained shear strengths, and boundary conditions. Undrained slope stability analyses for the cross section of the levee will be performed using Spencer's method in GeoStudio's SLOPE/W[®]. SLOPE/W[®] uses an iteration scheme to find the critical slip surface and the corresponding minimum factor of safety. The factors of safety for sliding (block) and circular modes of failure will be calculated in the analyses. Steady-state seepage analysis will be performed using GeoStudio's SEEP/W[®], a two dimensional finite element modeling program. SEEP/W[®] results provide values for the resultant seepage gradients.

The phreatic surface and pore-pressure distribution were modeled for every foot of head from the toe of the levee to the top of the dike. The approximate height of the levee cross section being modeled is 9 feet from natural ground (elevation 49 feet, NAVD88). Variables for stability analysis modeling include the internal friction angle (Φ) and cohesion (c) for both the embankment material and foundation material. Variables for seepage analysis include coefficient of volumetric compressibility (M_v), and the ratio of vertical to horizontal hydraulic conductivity (K_y/K_x). A standard deviation is then assigned to each variable (usually greater deviation for lower valued variables, and lower deviation for higher valued variables). The model is then recalculated changing one variable's input parameter by the standard deviation (higher and lower value). For the stability analysis, the four random variables will yield nine different model runs at each foot of head. This includes the base model, as well as the embankment friction angle, foundation friction angle, embankment cohesion, and foundation cohesion each changed by one standard deviation both higher and lower. For through seepage and underseepage, the two random variables will yield five different model runs at each foot of head. This includes the base model, as well as coefficient of volumetric compressibility and hydraulic conductivity ratio changed by one standard deviation both higher and lower. Each one foot of head will produce twelve different model runs utilizing the GeoStudio's program. For the Princeville modeling effort, nine different water surface elevations will be analyzed, with an expected number of model runs utilizing all random variables to be approximately 108.

The reliability function was then formulated for selected failure mechanisms and the constituting failure modes. Once the output from SLOPE/W[®] and SEEP/W[®] is calculated (F.S., hydraulic gradient), it is entered into an excel spreadsheet, which has pre-determined formulas for those inputs (Figure 21). The probability of failure points (PFP) for different water elevations is then generated. Levee reliability utilizing the probable failure point (PFP) at 85% and probable non-failure point (PNP) of 15% is then determined. Once the results are calculated, they are graphically plotted for a resulting fragility curve $[Pr(f) \text{ -vs- water elevation}]$ (Figure 22 & 23).

7.1 Fragility Analysis Results

Cross sections at Stations 32+00 and 74+00 were chosen to perform the fragility analysis. The fragility analysis was performed for both embankment stability and embankment through-seepage for both stations. The results for the embankment through-seepage indicate that the

probability of failure remains at almost 0% for all loading conditions (0-9 feet) for both stations. The fragility analysis for embankment stability indicates that the reliability of the levee decreases with increases in water elevation. This function indicates the probability of structure failure conditional upon loading. However, even with levee fully loaded, the probability of failure for the embankment at STA 32+00 is 23.6% and is 24.8% for the embankment at STA 74+00.

These data are entered into the Hydraulic Engineering Center's Flood Damage Analysis (HEC-FDA) program with economic analyses following. ETL 1110-2-556 (Risk Based Analysis in Geotechnical Engineering for Support of Planning Studies) provides guidance on risk informed analysis in geotechnical engineering.

8. Settlement

Historical inspection data and boring logs do not indicate any significant settlement of the existing levee. Additional borings along the selected alignment are needed for settlement analysis. If the analysis indicates any settlement in the embankment or the foundation, the final design will accommodate for this.

9. Earthquakes and Potential for Liquefaction

The Princeville levee project is in a seismic Zone 1 (least susceptible to earthquakes), therefore; earthquake loadings were not considered in analyzing the stability of the levee. Also, the probability of an earthquake coinciding with periods of high water conditions is low. Earthquake impacts on the levee and the potential for liquefaction are not evaluated in this study and will not be required for the final design.

10. Geotechnical Investigations Deferred to PED Phase

A geotechnical investigation is to be deferred to PED phase for the recommended plan of the Princeville Flood Risk Management project. Current boring data in the recommended plan consists of two subsurface Standard Penetration Tests (SPT) borings and one core sample taken in 2006. Drilling, laboratory testing, seepage and stability analysis, and development of a fragility curve for the recommended plan is recommended prior to construction. This investigation should include SPT borings along the actual alignment and undisturbed sampling of any shallow fat clay (CH) or soft soil layers that may be present. If it is determined that more borrow is necessary, other areas should also be investigated. Additional subsurface information needed for the selected alternative includes Standard Penetration Test (ASTM D 1586) and Thin-Walled Tube Sampling (ASTM D 1587). Recommended laboratory tests include Particle Size Analysis (ASTM D 6913), Moisture Content Determination (ASTM D 2216), Visual Classification (ASTM D 2487), Standard Proctor (ASTM D 698), and Atterberg Limits (ASTM D 4318). After further investigations and testing, all analyses should be reviewed and recalculated, if necessary, utilizing GeoStudio's SEEP/W[®] and SLOPE/W[®] programs.

11. Foundation Preparation during Construction

As is common in levee construction, the foundation should be properly prepared prior to placement of the embankment to minimize potential problems with stability, settlement, and seepage. This involves clearing and grubbing all woody vegetation, as well as the removal of any debris that may be present. An exploration trench (inspection trench) should be excavated under the levee to intercept any undesirable underground features. These can include water or sewer lines, buried logs, or other debris. Unsuitable materials in the subgrade should be removed and the foundation disked and compacted to bond with the embankment.

12. Embankment Placement/Compaction

Much of the existing levee embankment was constructed with clayey sand and poorly graded sand with clay, and has performed well under flooding conditions. For the new embankment levee, similar performance should be expected with similar soil types. However, it is recommended that for the final design, a minimum percentage of fines be specified for embankment construction to reduce seepage problems developing during a flood event. Underseepage of the new embankment should not be a concern unless the surficial soils encountered are clean sands or gravels. If these materials are encountered, they should be removed to a depth determined in the final design and replaced with soils containing fine-grained material. This will be evaluated prior to construction.

Standard placement procedures to be used during construction of the levee include the repetitive process of disking, placement in lifts, and compaction of the soil to a specified density. Moisture-density control will be required and frequent field density tests performed to assure quality control. Compaction requirements are based on the properties of the borrow material. Compaction, hydraulic conductivity, and direct shear tests were performed on the borrow area samples in the laboratory to determine soil parameters.

13. Summary of Results

The following is a summary of geotechnical study results:

- a) The stability analyses of the existing levee meet the required minimum factor of safety at stations 34+00, 38+00, 40+00, and 70+00 (calculated factors of safety range from 1.50 to 1.79) based on the assumptions and geotechnical information available. The safety factor of these existing cross sections satisfies the minimum required safety factor of 1.4, as per EM 1110-2-1913.
- b) The rapid drawdown stability analysis of the existing levee meets the minimum factor of safety at stations 32+00, 34+00, 40+00, and 74+00 (minimum factors of safety from 1.07 to 1.42). This satisfies the minimum safety factor of 1.0 as per EM 1110-2-1913.
- c) Results of the seepage analysis show through- and under-seepage of the existing levee are minor under short term high water conditions. This appears consistent with the function of the existing levee during flood events. The hydraulic gradients range from - 0.224 to 0.389 for the 0.01 probability of exceedance flood event at all stations. This satisfies the maximum hydraulic gradient of 0.5 as per EM 1110-2-1913.
- d) Seepage pore water pressure within the existing levee is minor and the phreatic surface was near the landside toe of the slope. Lateral hydrostatic forces and seepage gradients within the levee and underlying foundation indicate the overall stability of the existing levee is acceptable.

14. Recommendations

- a) Perform additional subsurface investigation during PED phase for the alignments of the selected plan. This investigation should be focused along the alignments to define the subsurface conditions and strength parameters of the foundations. The borings should extend deep enough for analysis where sheet piling or wall foundations are proposed.
- b) Conduct further geologic mapping and correlate with the NRCS Soils Survey Map.

- c) Determine required and available quantities of suitable borrow material and investigate new or expanded borrow areas.
- d) Perform laboratory testing on representative samples from the selected levee alignments to determine strength parameters and permeability of shallow sandy soils. Perform consolidation tests on any fine-grained soils considered problematic. Perform laboratory compaction tests of expanded borrow area samples as needed for the final design.
- e) Establish recommended placement and compaction requirements for design based on analysis and laboratory data.
- f) For the selected plan, perform slope stability analysis encompassing deep seated and shallow rotational and wedge failures using SLOPE/W[®] stability software. Also, perform seepage analysis utilizing SEEP/W[®] seepage software. Both analyses should utilize any additional subsurface information.
- g) Perform settlement calculations for the design of the new levee.
- h) Review historical aerial photography and topographic information to determine the locations old channels and other drainage features. These historical features may present design challenges.
- i) During construction of the selected plan, clear and grub all woody vegetation, as well as the remove any debris that may be present. Unsuitable materials in the subgrade, such as clays and silts, should be removed and the foundation disked and compacted to bond with the embankment.
- j) A minimum percentage of fines should be specified for embankment construction to reduce seepage problems developed during a flood event.
- k) The stability of the embankment for the final selected plan should be evaluated for the final design using additional subsurface information.
- l) The US Highway 64 road fill will be investigated and analyzed to determine if it meets the Corps design standards required for levees.
- m) Conduct a probabilistic levee analysis on the preferred alignment of the proposed levee.

15. Sources Cited

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Table 1. Summary of 2006 and 2009 Boring Data

Boring Name	Easting	Northing	Ground Surface	Total	Date
			Elevation (ft) MSL	Depth (ft)	Completed
PD-B-64-1	776319	2435980	50.0	30.0	4/18/2009
PD-B-64-2	776649	2435921	45.0	30.0	4/18/2009
PD-B-64-3	776731	2436009	48.0	15.0	4/18/2009
PD-BP-BA-1	770503	2455035	35.0	15.0	4/14/2009
PD-BP-BA-2	770144	2455406	35.0	15.0	4/14/2009
PD-BP-BA-3	770316	2455889	35.0	15.0	4/14/2009
PD-BP-BA-4	770720	2456152	35.0	15.0	4/15/2009
PD-BP-BA-5	770788	2455600	35.0	15.0	4/15/2009
PD-BP-SS-1	782491	2434632	34.0	15.0	4/15/2009
PD-BP-SS-2	782502	2434579	49.0	30.0	4/15/2009
PD-BP-SS-3	783714	2437544	49.0	30.0	4/15/2009
PD-BP-SS-4	783708	2437393	49.0	30.0	4/16/2009
PD-BP-SS-5	783726	2438337	49.0	30.0	4/16/2009
PD-BP-SS-6	783672	2437420	38.0	15.0	4/17/2009
PD-BP-SS-7	783685	2437520	45.0	15.0	4/17/2009
PD-BP-SS-8	783817	2438339	36.0	15.0	4/17/2009
PD-BP-SS-9	783734	2437425	38.0	15.0	4/17/2009
PD-BP-SS-10	783765	2437525	40.0	15.0	4/17/2009
PD-BP-SS-11	783861	2438341	34.0	15.0	4/17/2009
PFR-06-SS-1	776368	2435605	43.4	25.5	7/19/2006
PFR-06-SS-5	779031	2435326	44.7	30.0	7/20/2006
PFR-06-SS-6	779896	2434686	47.5	31.0	7/20/2006
PFR-06-SS-11	784838	2442112	46.4	15.5	7/18/2006
PFR-06-SS-12	785318	2443114	46.5	15.6	7/18/2006
PFR-06-SS-13	786338	2444685	47.4	15.5	7/18/2006
PFR-06-SS-14	787418	2445659	45.5	15.6	7/18/2006
PFR-06-SS-17	781264	2443542	48.9	15.5	7/19/2006
PFR-06-SS-18	780515	2445158	48.4	15.5	7/19/2006
PFR-06-SS-19	779979	2447467	49.1	15.6	7/19/2006
PFR-06-SS-20	780139	2449866	48.1	15.5	7/18/2006
PFR-06-GP-02	776969	2435606	42.8	30.0	6/29/2006
PFR-06-GP-03	777626	2435580	43.9	30.0	6/29/2006
PFR-06-GP-04	778302	2435487	43.6	30.0	6/29/2006
PFR-06-GP-05	779031	2435326	44.7	30.8	6/28/2006
PFR-06-GP-06	779896	2434686	47.5	30.6	6/28/2006
PFR-06-GP-15	787154	2446244	44.6	15.5	6/29/2006
PFR-06-GP-16	785737	2447024	47.8	15.5	6/29/2006
PFR-06-CS-07	784438	2441259	46.9	4.1	6/22/2006
PFR-06-CS-08	785725	2443958	45.9	4.4	6/22/2006
PFR-06-CS-09	787652	2445863	46.4	4.1	6/22/2006
PFR-06-CS-10	786342	2446693	46.6	3.3	6/22/2006
PFR-06-A-1	776249	2443464		5.0	7/21/2006
PFR-06-A-2	776428	2443654		7.5	7/21/2006
PFR-06-A-3	777217	2444081		5.0	7/21/2006
PFR-06-A-4	778158	2444561		6.5	7/21/2006

Table 2. Summary of Index Testing Results

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-64-1	1.5	3.0	2	SILTY SAND, fine-grained, trace of clay, brown (SM)	4	12	23	-
	12.0	13.5	9	SILTY SAND, poorly sorted, fine-grained, little clay, dry, light brown (SM)	18	9	21	-
	27.0	28.5	19	SAND, poorly sorted, fine to coarse-grained, trace of clay, light brown (SP)	30	14	5	-
PD-BP-64-2	1.5	3.0	2	CLAYEY SAND, medium-grained, trace of silt, light brown (SC)	12	10	28	-
	4.5	6.0	4	SILTY SAND, poorly sorted, fine-grained, dark brown (SM)	7	10	39	-
	6.0	7.5	5	CLAYEY SAND, poorly sorted, fine-grained, little silt, reddish brown (SC)	7	15	42	-
	15.0	16.5	11	SAND, poorly sorted, fine to coarse-grained, trace of silt, light brown (SP)	8	16	3	-
	19.5	21.0	14	CLAYEY SAND, fine-grained, trace of silt, dry, greenish gray (SC)	41	18	19	-
	22.5	24.0	16	CLAY, stiff, medium plasticity, little fine-grained sand, trace of silt, greenish gray (CL)	30	19	88	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-64-3	3.0	4.5	3	CLAYEY SAND, fine-grained, trace of silt, light brown (SC)	5	15	44	-
	6.0	7.5	5	SAND, poorly sorted, medium-grained, little clay, wet, light gray (SP)	4	21	4	-
	9.0	10.5	7	CLAY, stiff, medium plasticity, little fine-grained sand, trace of silt, woody fragments, green (CL)	8	25	-	25
	12.0	13.5	9	SILTY SAND, poorly sorted, little clay, light gray (SM)	20	22	19	-
	13.5	15.0	10	CLAY, stiff, medium plasticity, some fine-grained sand (CL)	18	21	-	15
PD-BP-BA-1	9.0	10.5	7	SAND with CLAY, poorly sorted, fine and medium-grained, light reddish brown (SP-SC)	5	24	9	-
PD-BP-BA-2	3.0	4.5	3	CLAYEY SAND, poorly sorted, fine-grained, moist, light reddish brown (SC)	3	14	32	-
	12.0	13.5	9	SAND, poorly sorted, fine to medium-grained, light brown (SP)	8	21	2	-
PD-BP-BA-3	0.0	1.5	1	SILTY SAND, fine-grained, trace of clay, trace of organics, brown (SM)	7	2	19	-
	3.0	4.5	3	SAND with CLAY, fine-grained, poorly sorted, light reddish brown (SP-SC)	4	6	8	-
	12.0	13.5	9	SAND with CLAY, poorly sorted, fine and medium-grained, light gray/light brown (SP-SC)	5	20	11	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-BA-4	0.0	1.5	1	SILTY SAND, fine-grained, trace of clay, trace of organics, roots, brown (SM)	2	7	15	-
	3.0	4.5	3	SILTY SAND, fine-grained, poorly sorted, trace of silt, light brown (SM)	3	10	16	-
	10.5	12.0	8	CLAYEY SAND, poorly sorted, fine to coarse-grained, little clay, light brown (SC)	7	22	17	-
PD-BP-BA-5	0.0	1.5	1	SILTY SAND, fine-grained, trace of clay, trace of organics, brown (SM)	8	5	22	-
	3.0	4.5	3	CLAYEY SAND, poorly sorted, fine-grained, light brown (SC)	6	8	16	-
	10.5	12.0	8	SAND, poorly sorted, fine and medium-grained, trace of clay, light brown (SP)	2	26	3	-
PD-BP-SS-1	0.0	1.5	1	SILTY SAND, medium-grained, little clay, trace of organics, roots, reddish brown (SM)	4	5	13	-
	3.0	4.5	3	CLAYEY SAND, poorly sorted, medium-grained, trace of silt, light brown (SC)	15	9	14	-
	6.0	7.5	5	CLAY, stiff, low plasticity, little silt, little fine-grained sand, light gray (CL)	9	18	-	15
	10.5	12.0	8	SAND with CLAY, poorly sorted, medium-grained (SP-SC)	7	15	9	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-SS-2	1.5	3.0	2	CLAYEY SAND, fine-grained, trace of silt, reddish brown (SC)	10	11	41	-
	6.0	7.5	5	CLAY, soft, low plasticity, some fine-grained sand, trace of silt, reddish brown (CL)	9	13	-	12
	10.5	12	8	CLAYEY SAND, fine-grained, trace of silt, brown (SC)	6	13	39	-
	13.5	15.0	10	CLAY, stiff, medium plasticity, little fine-grained sand, trace of silt, reddish brown (CL)	4	16	-	21
	22.5	24.0	16	SAND, poorly sorted, medium and coarse-grained, light brown (SP)	16	15	2	-
PD-BP-SS-3	0.0	1.5	1	CLAY, stiff, low plasticity, some fine-grained sand, trace of silt, trace of gravel $\frac{3}{4}$ " diameter, reddish brown (CL)	10	10	-	19
	9.0	10.5	7	SAND with CLAY, poorly sorted, fine and medium-grained, trace of silt, reddish brown (SP-SC)	25	5	8	-
	22.5	24.0	16	CLAY, stiff, medium plasticity, some coarse-grained sand, trace of silt, light gray (CL)	10	22	-	22
	27.0	28.5	19	CLAYEY SAND, fine-grained, gray (SC)	28	13	25	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-SS-4	4.5	6.0	4	CLAYEY SAND, fine-grained, little silt, brown (SC)	12	10	41	-
	12.0	13.5	9	CLAYEY SAND, poorly sorted, fine-grained, trace of silt, light brown (SC)	14	8	18	-
	25.5	27.0	19	CLAY, stiff, low plasticity, little fine-grained sand, roots, dry, gray (CL)	14	25	-	35
PD-BP-SS-5	4.5	6.0	4	CLAYEY SAND, fine-grained, trace of silt, reddish brown (SC)	8	15	43	-
	13.5	15.0	10	SAND with SILT, poorly sorted, fine-grained, light brown (SP-SM)	34	11	11	-
	18.0	19.5	13	CLAYEY SAND, fine-grained, gray (SC)	6	16	42	-
	24.0	25.5	17	SAND, poorly sorted, medium and fine-grained, trace of clay, white/gray (SP)	5	21	4	-
	28.5	30.0	20	CLAY, stiff, medium plasticity, little fine-grained sand, trace of silt, gray (CL)	35	21	-	27

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-SS-6	0.0	1.5	1	CLAY, sandy, trace of silt, roots, reddish brown (CL)	5	15	52	-
	4.5	6.0	4	SAND with CLAY, poorly sorted, fine-grained, light brown (SP-SC)	28	6	10	-
	9.0	10.5	7	CLAY, soft, low plasticity, some fine-grained sand, trace of silt, gray (CL)	4	18	-	11
	12.0	13.5	9	CLAYEY SAND, coarse and fine-grained, trace of silt, gray (SC)	10	15	40	-
PD-BP-SS-7	0.0	1.5	1	CLAYEY SAND, fine-grained, trace of silt, roots, reddish brown (SC)	5	8	20	-
	4.5	6.0	4	SAND with CLAY, poorly sorted, fine and medium-grained, light brown (SP-SC)	30	7	8	-
	9.0	10.5	7	CLAY, stiff, medium plasticity, trace of silt, roots, gray (CL)	3	17	-	13
	12.0	13.5	9	CLAYEY SAND, coarse-grained, trace of silt, light gray (SC)	9	12	39	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-SS-8	0.0	1.5	1	CLAY, stiff, low plasticity, some fine-grained sand, trace of silt, roots, reddish brown (CL)	8	13	-	18
	4.5	6.0	4	CLAYEY SAND, poorly sorted, medium and fine-grained, little organics, light gray (SC)	20	8	21	-
	7.5	9.0	6	SILTY SAND, fine-grained, trace of clay, moist, dark gray (SM)	29	16	27	-
	9.0	10.5	7	SILTY SAND, fine grained, some clay, reddish brown (SM)	5	22	19	-
	12.0	13.5	9	CLAYEY SAND, fine-grained, poorly sorted, trace of silt, gray (SC)	2	25	13	-
PD-BP-SS-9	0.0	1.5	1	CLAYEY SAND, fine-grained, trace of silt, roots, reddish brown (SC)	12	7	19	-
	4.5	6.0	4	CLAYEY SAND, fine-grained, poorly sorted, trace of silt, light brown (SC)	10	11	27	-
	11.0	12.0	8	CLAYEY SAND, trace of silt, moist, gray (SC)	6	15	39	-

**Table 2. Summary of Index Testing Results
(cont.)**

Boring Name	Stratum Upper Depth (ft)	Stratum Lower Depth (ft)	Sample Number	Soil Description	SPT N-value (blows/ft)	Moisture Content (%)	Percent Passing U.S. Std. No. 200 Sieve (%)	Plasticity Index
PD-BP-SS-10	0.0	1.5	1	CLAYEY SAND, fine-grained, trace of silt, roots, reddish brown (SC)	12	6	24	-
	3.5	4.5	3	CLAYEY SAND, poorly sorted, fine-grained, trace of silt, reddish brown (SC)	12	11	30	-
PD-BP-SS-11	3.0	4.5	3	SAND with CLAY, poorly sorted, fine-grained, trace of silt, reddish brown (SP-SC)	17	10	12	-
	10.5	12.0	8	CLAYEY SAND, poorly sorted, medium-grained, moist, light brown (SC)	10	12	16	-

Table 3. Summary of Compaction Test Results

Sample ID	Sample Description	Optimum Moisture Content (%)	Maximum Dry Density (lb/ft³)
Box 1	Light brown sand with clay, trace roots	12.8	112.4
Box 2	Light brown sand with silt, trace roots	11.0	115.4
Box 3	Light brown sand with trace roots	16.0	108.7

Table 4. Summary of Hydraulic Conductivity Test Results

Sample ID	Initial Dry Density (pcf)	Final Moisture Content (%)	Initial Void Ratio	Vertical Hydraulic Conductivity (cm/sec)
Box 1	107.42	20.22	0.569	4.2×10^{-4}
Box 1	107.1	20.27	0.544	9.4×10^{-4}
Box 2	109.32	20.15	0.542	1.6×10^{-3}
Box 2	110.53	19.56	0.525	4.4×10^{-3}
Box 3	101.71	21.05	0.627	2.1×10^{-2}
Box 3	101.56	21.82	0.629	2.4×10^{-2}

Table 5 Summary of Direct Shear Test Results

Sample ID	Sample Description	Percent By Weight Passing the No. 200 sieve (%)	Cohesion, C (psf)	Effective friction angle (degrees)
Box 1	Brown clayey sand	14.6	144	34.8
Box 1	Brown clayey sand	13.8		
Box 1	Brown clayey sand	15.9		
Box 2	Brown medium to fine sand with silt	11.7	0	41.3
Box 2	Brown medium to fine sand with silt	12		
Box 2	Brown medium to fine sand with silt	11.9		
Box 3	Yellowish-brown medium to fine sand	2	0	40.3
Box 3	Yellowish-brown medium to fine sand	2.4		
Box 3	Yellowish-brown medium to fine sand	3.1		

Table 6. Seepage Analysis Results

Station 32+00		
Flood Event	Riverside Water Elevation	Hydraulic Gradient at Toe
0.01 Probability of Exceedance	48 ft	0.290

Station 38+00		
Flood Event	Riverside Elevation	Hydraulic Gradient at Toe
0.01 Probability of Exceedance	48 ft	0.278

Station 40+00		
Flood Event	Riverside Elevation	Hydraulic Gradient at Toe
0.01 Probability of Exceedance	48 ft	0.224

Station 74+00		
Flood Event	Riverside Elevation	Hydraulic Gradient at Toe
0.01 Probability of Exceedance	48 ft	0.389

Table 7. Stability Analysis Results

Station 32+00	
Slope Stability Factor of Safety	1.603
Rapid Drawdown Stability Factor of Safety	1.070

Station 38+00	
Slope Stability Factor of Safety	1.587
Rapid Drawdown Stability Factor of Safety	1.358

Station 40+00	
Slope Stability Factor of Safety	1.791
Rapid Drawdown Stability Factor of Safety	1.400

Station 74+00	
Slope Stability Factor of Safety	1.500
Rapid Drawdown Stability Factor of Safety	1.421

Table 8 Soil Characteristics

Station	Boring Name	Soil Description	Saturated Unit Weight (pcf)	Φ' (Degrees)	Cohesion (psf)
32+00	PD-BP-SS-5, PD BP-SS-8, PD-BP-SS-11	Loose Sands (SP) to Clayey Sands (SC)	120-125	28-30	-
		Medium dense to dense silty sands (SM) to clayey sands (SC)	125-135	33-36	-
		Stiff Clay (CL)	130-135	-	1000-2000
34+00	PD-BP-SS-3, PD-BP-SS-7, PD-BP-SS-10	Medium dense to dense sands (SP), sands with clay (SP-SC), and clayey sands (SC)	120-125	31-35	-
		Very loose to medium dense silty sands (SM) and clayey sands (SC)	120-135	29-35	-
		Medium stiff to stiff clay (CL)	130-135	-	1000
		Medium dense silty sands (SM), and clayey sands (SC)	125-135	31-34	-
		Stiff Clay (CL)	120-125	-	1000-1200
40+00	PD-BP-SS-4, PD-BP-SS-6, PD-BP-SS-9	Loose to medium dense silty sand (SM) and clayey sand (SC)	120-125	30-34	-
		Very loose to loose silty sands (SM) and clayey sands (SC)	120-125	29-31	-
		Very stiff clay (CL)	125-135	-	1000-2000
74+00	PD-BP-SS-1, PD-BP-SS-2	Loose to medium dense clayey sands (SC)	115-120	30-31	-
		Loose to dense silty sands (SM), and clayey sands (SC)	120-125	30-35	-
		Loose to medium dense sands (SP) and sands with clay (SP-SC)	120-125	30-32	-

Attachment 1

Figures

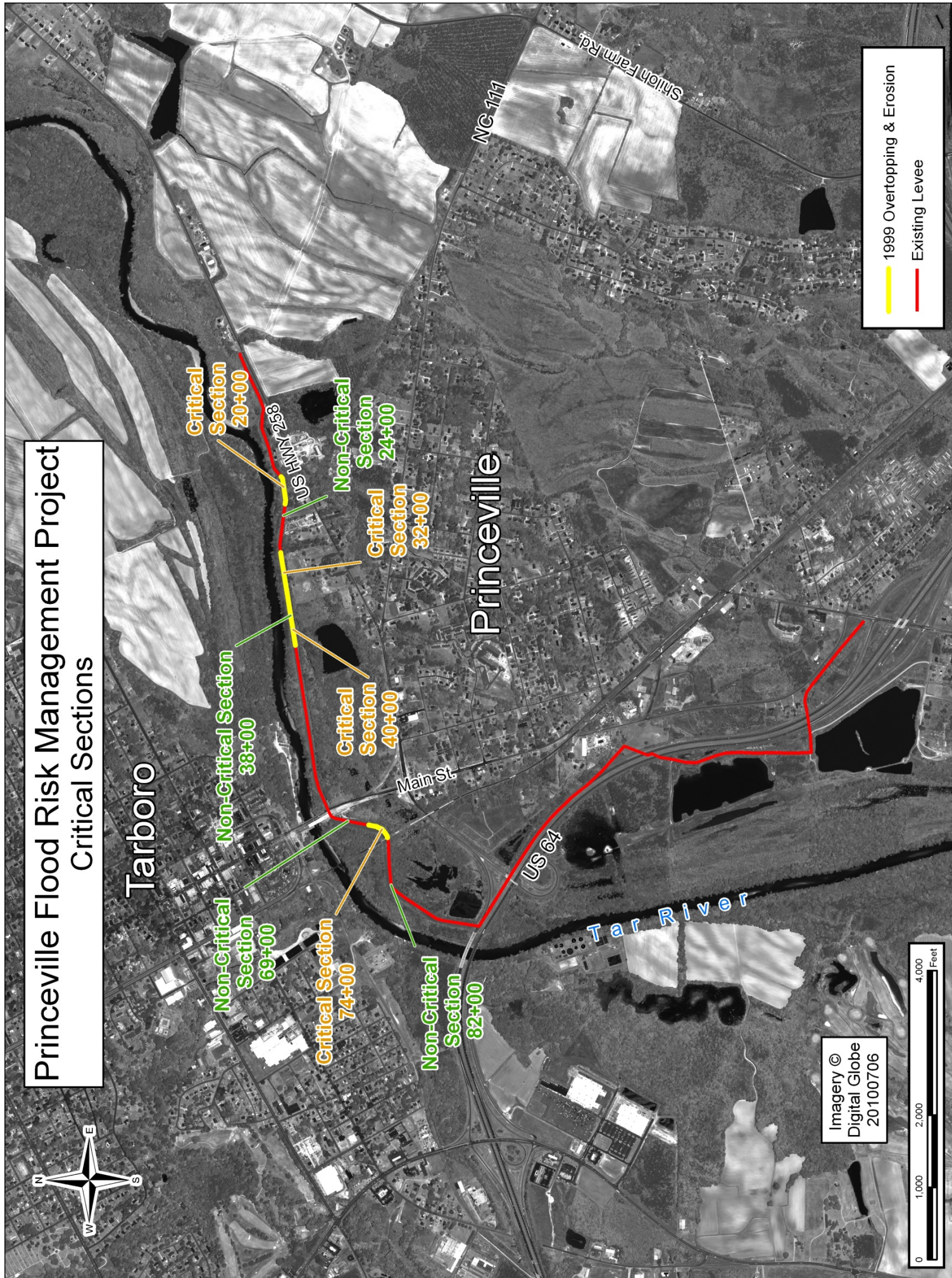
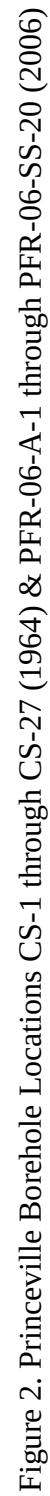
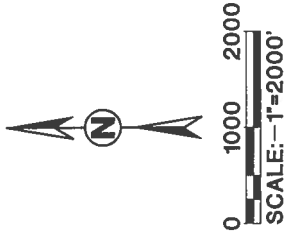
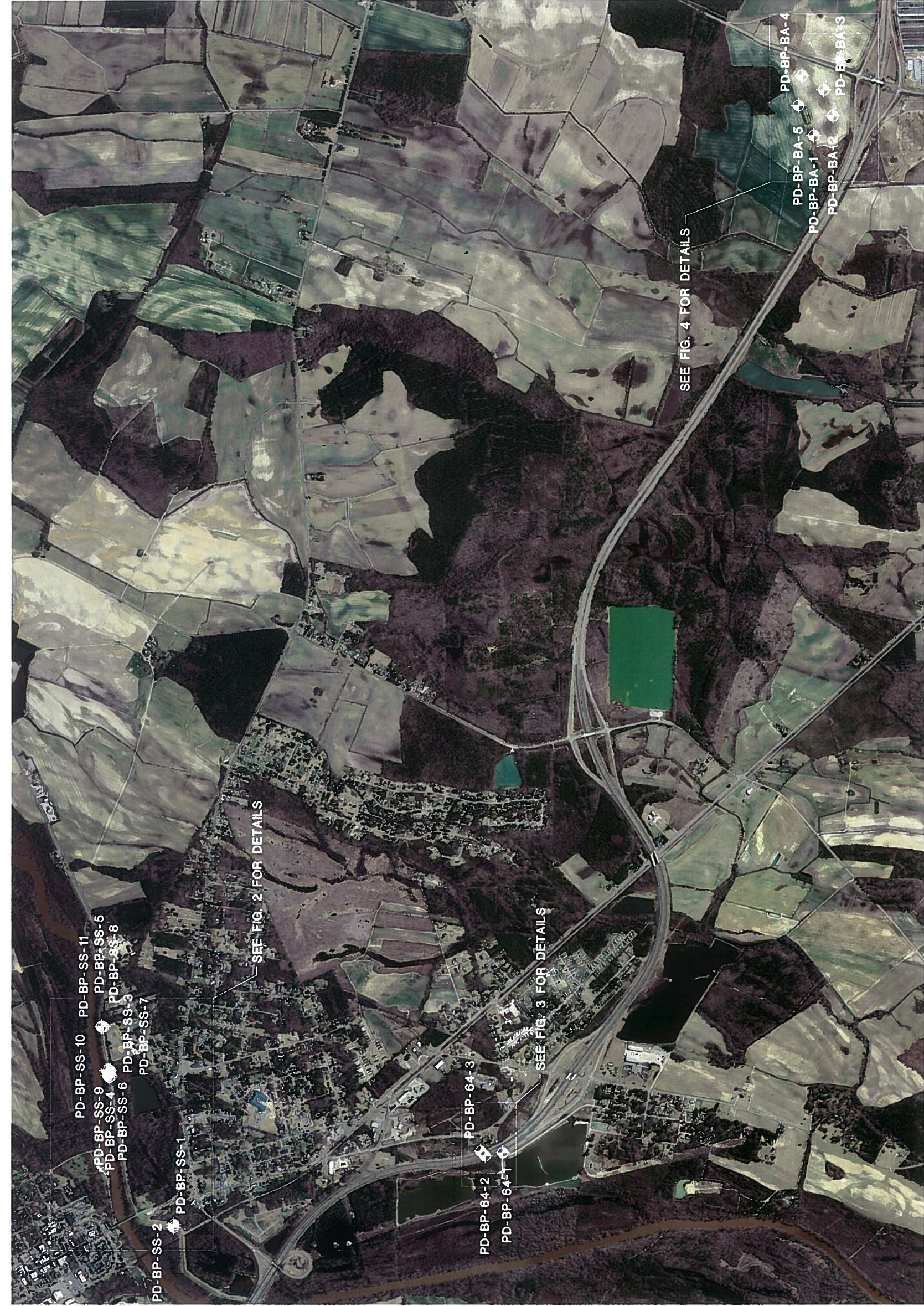


Figure 1. Princeville Flood Damage Reduction Site Map





AERIAL PHOTOGRAPH OBTAINED FROM
NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
FLOWN BY FURGO EARTHDATA, INC.
FLIGHT DATE: 09/05/2008

BORING LOCATION PLAN PD-BP-SS-1 TO PD-BP-BA-5			
 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants			
U.S. ARMY CORPS OF ENGINEERS PRINCEVILLE FLOOD REDUCTION PROJECT WILMINGTON DISTRICT, NORTH CAROLINA			
DRAWN BY: RDC	CHECKED BY:	DATE: 07/08/09	FIGURE: 1
FILE NO. 09-177	APPROVED BY:		

Figure 3. Princeville Borehole Locations PD-SS-1 through BP-BA-5 (2009 Subsurface Investigation)



Figure 4. Princeville Boring Locations 2009 Northern Portion



BORING LOCATION PLAN
PD-BP-64-1 TO PD-BP-64-3

**Ardaman & Associates, Inc.**
Geotechnical, Environmental and
Materials Consultants

U.S. ARMY CORPS OF ENGINEERS
PRINCEVILLE FLOOD REDUCTION PROJECT
WILMINGTON DISTRICT, NORTH CAROLINA

DRAWN BY:	RDC	CHECKED BY:		DATE:	07/08/09
FILE NO.	08-177	APPROVED BY:		FIGURE:	3

Figure 5. Princeville Boring Locations 2009 Western Portion



R:\Corporate\09\09-177\09177-04.dwg 10/22/2009 4:49:49 PM, Richard.Clemons

Figure 6. Princeville Boring Locations 2009 Borrow Area

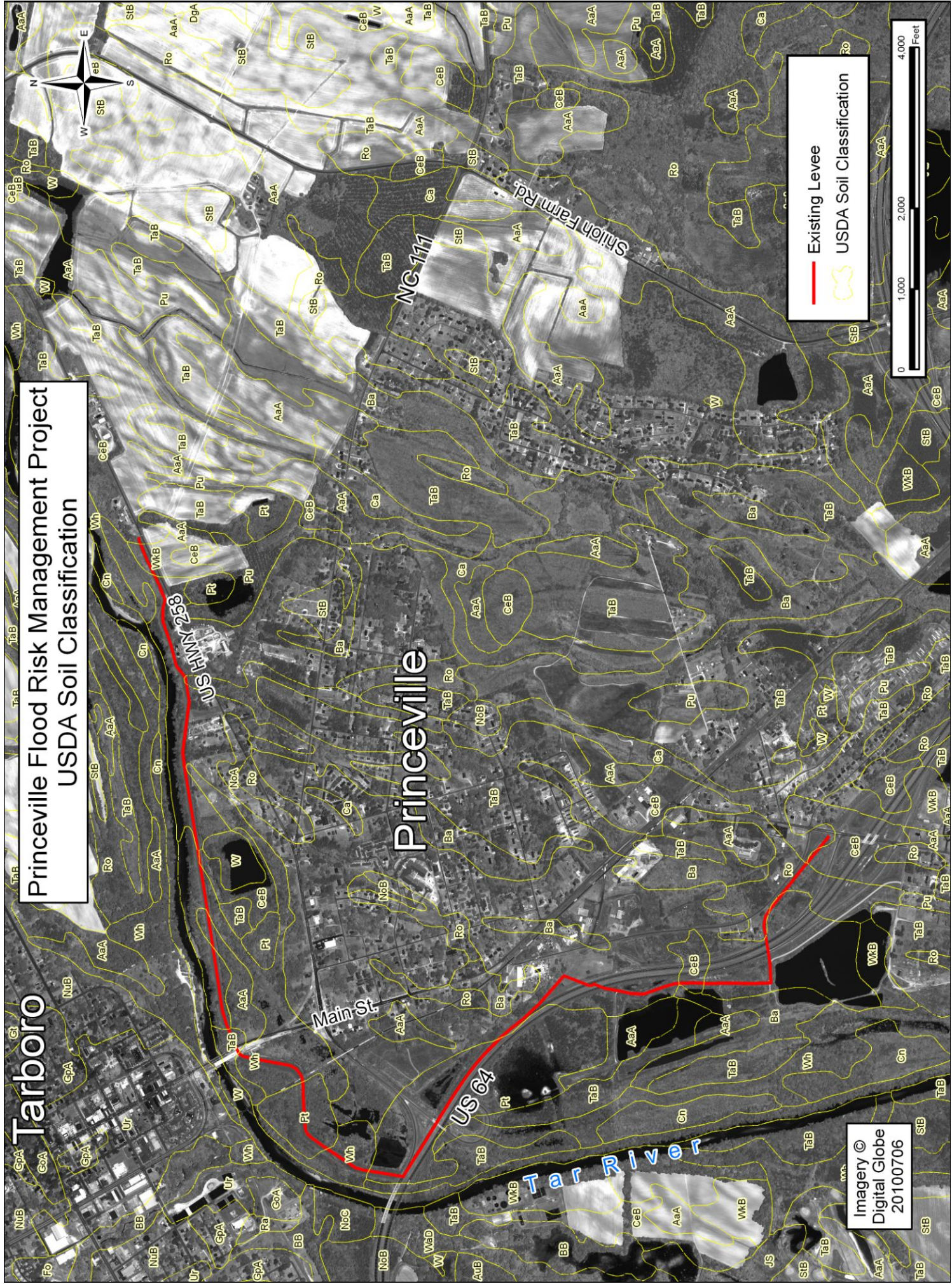


Figure 7. Edgecombe County Soils Map

Map Unit Legend

Edgecombe County, North Carolina (NC065)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AaA	Altavista fine sandy loam, 0 to 3 percent slopes	929.1	13.7%
AuB	Autryville loamy sand, 0 to 6 percent slopes	172.1	2.5%
Ba	Ballahack fine sandy loam	272.6	4.0%
BB	Bibb soils	126.6	1.9%
Ca	Cape Fear loam	274.8	4.1%
CeB	Conetoe loamy sand, 0 to 4 percent slopes	333.9	4.9%
Cn	Congaree (Shellbluff) silt loam	75.8	1.1%
DgA	Dogue fine sandy loam, 0 to 3 percent slopes	33.1	0.5%
Fo	Foreston loamy sand, 0 to 2 percent slopes	10.2	0.2%
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	19.3	0.3%
GpA	Goldsboro-Urban land complex, 0 to 2 percent slopes	68.5	1.0%
Gt	Grantham-Urban land complex	7.9	0.1%
JS	Johnston soils	20.1	0.3%
Ly	Lynchburg fine sandy loam	5.7	0.1%
NoA	Norfolk loamy sand, 0 to 2 percent slopes	10.0	0.1%
NoB	Norfolk loamy sand, 2 to 6 percent slopes	89.1	1.3%
NoC	Norfolk loamy sand, 6 to 10 percent slopes	8.8	0.1%
NuB	Norfolk-Urban land complex, 0 to 6 percent slopes	197.0	2.9%
Pt	Pits	107.0	1.6%
Pu	Portsmouth fine sandy loam	210.1	3.1%
Ra	Rains fine sandy loam	3.2	0.0%
Ro	Roanoke loam	1,293.3	19.1%
StB	State loamy sand, 0 to 4 percent slopes	305.3	4.5%
TaB	Tarboro loamy sand, 0 to 6 percent slopes	1,494.7	22.0%
Ur	Urban land	118.6	1.7%
W	Water	101.8	1.5%
WaB	Wagram loamy sand, 0 to 6 percent slopes	3.8	0.1%
WaD	Wagram loamy sand, 10 to 15 percent slopes	77.6	1.1%
We	Wahee fine sandy loam	1.3	0.0%
Wh	Wehadkee silt loam	281.7	4.2%
WkB	Wickham sandy loam, 0 to 4 percent slopes	127.0	1.9%
Totals for Area of Interest		6,780.0	100.0%

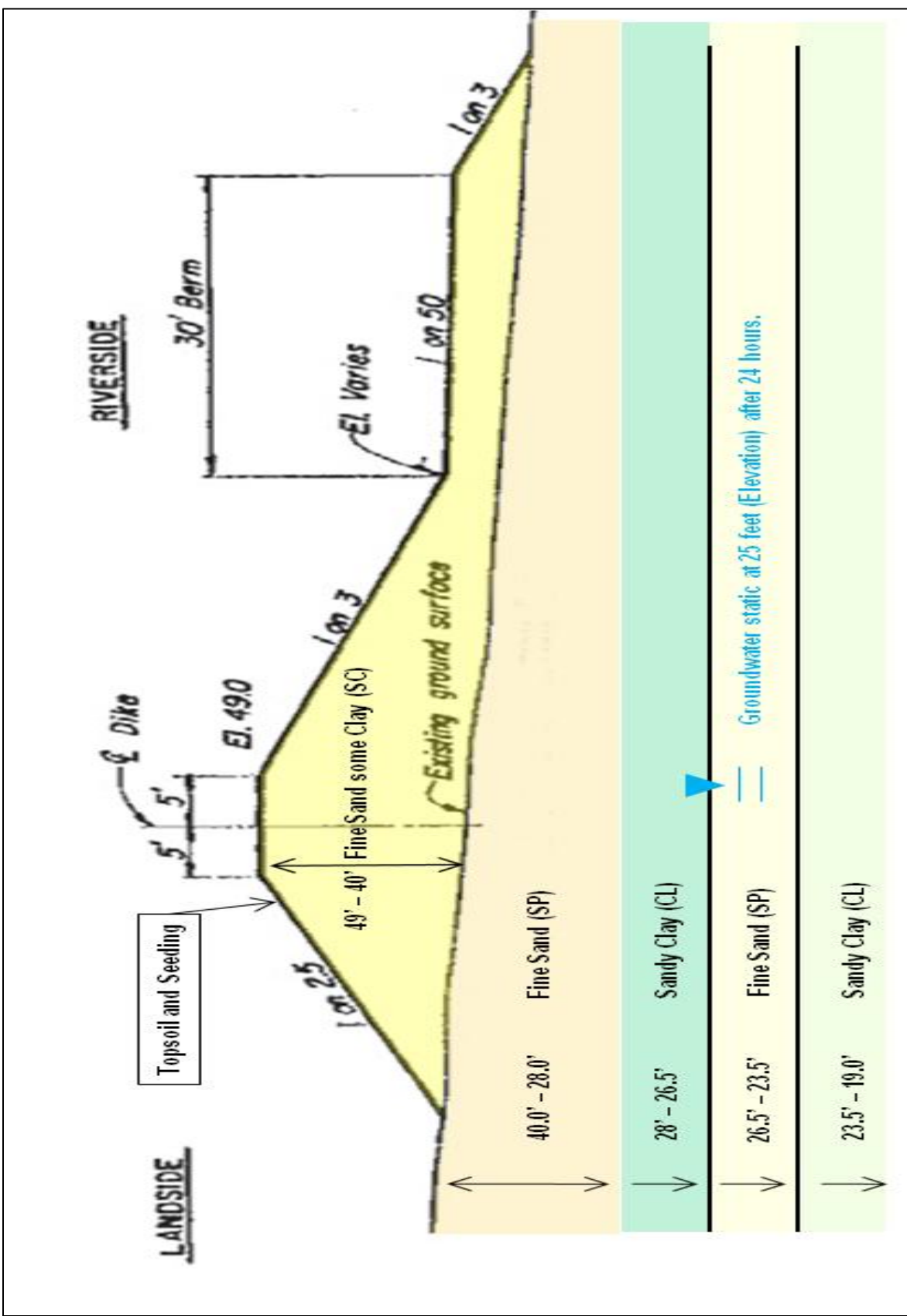


Figure 8. Typical Geomorphology/Foundation Geology of the Princeville Levee

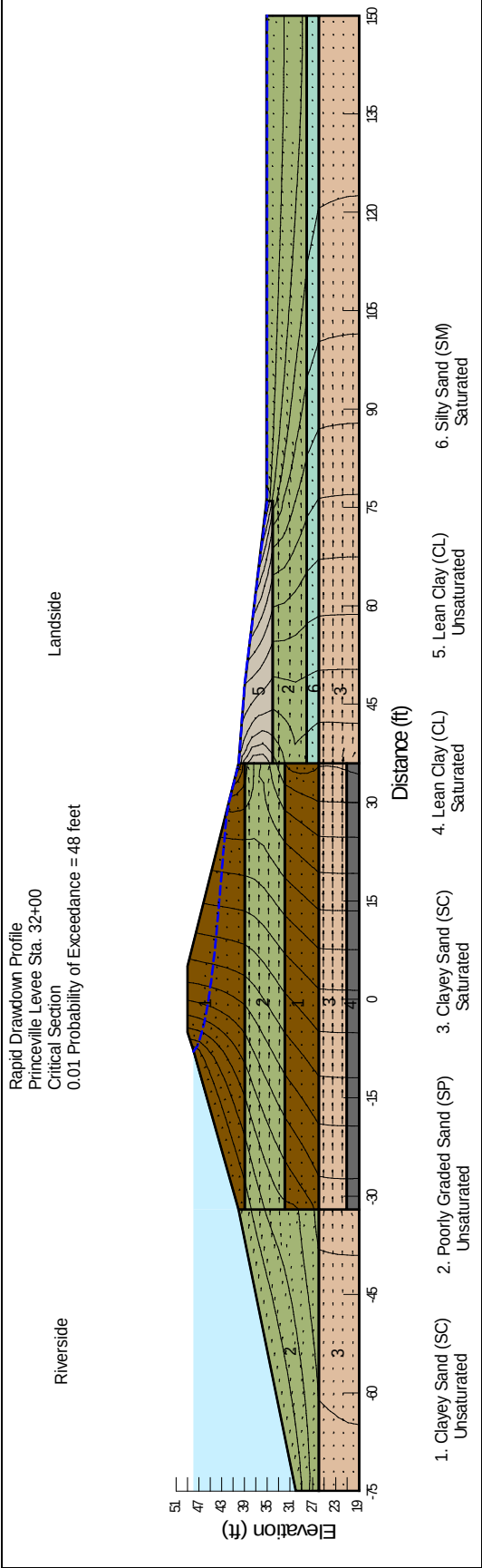


Figure 9. Seepage Profile, Station 32+00, 0.01 Probability of Exceedance, 48 feet

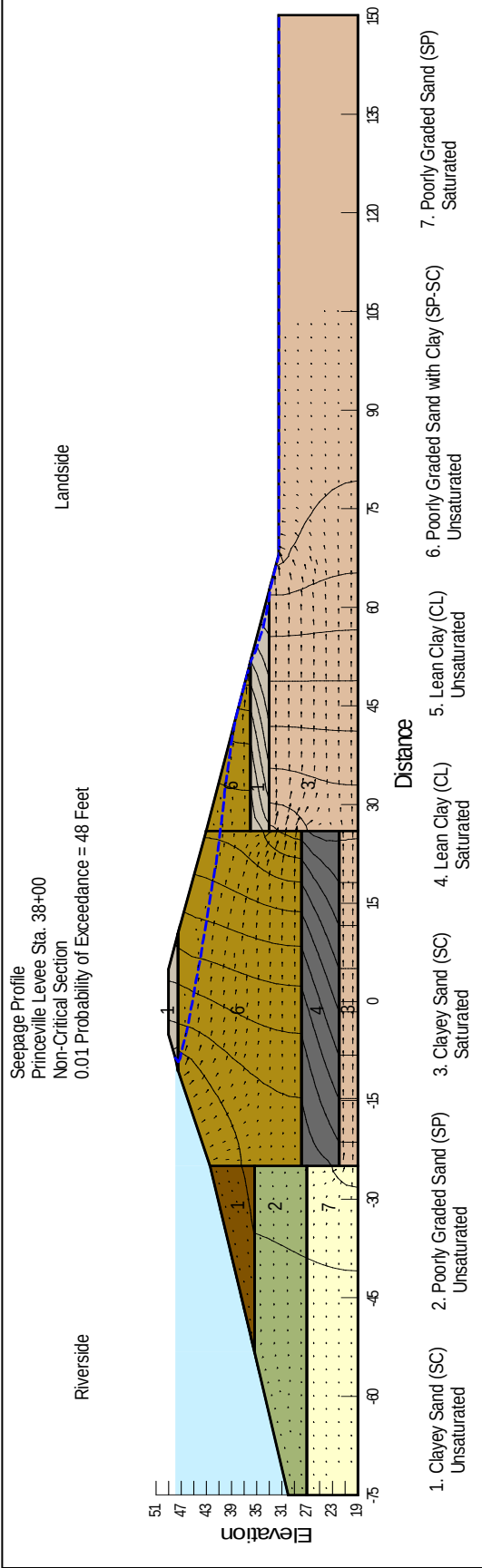


Figure 10. Seepage Profile, Station 38+00, 0.01 Probability of Exceedance, 48 Feet

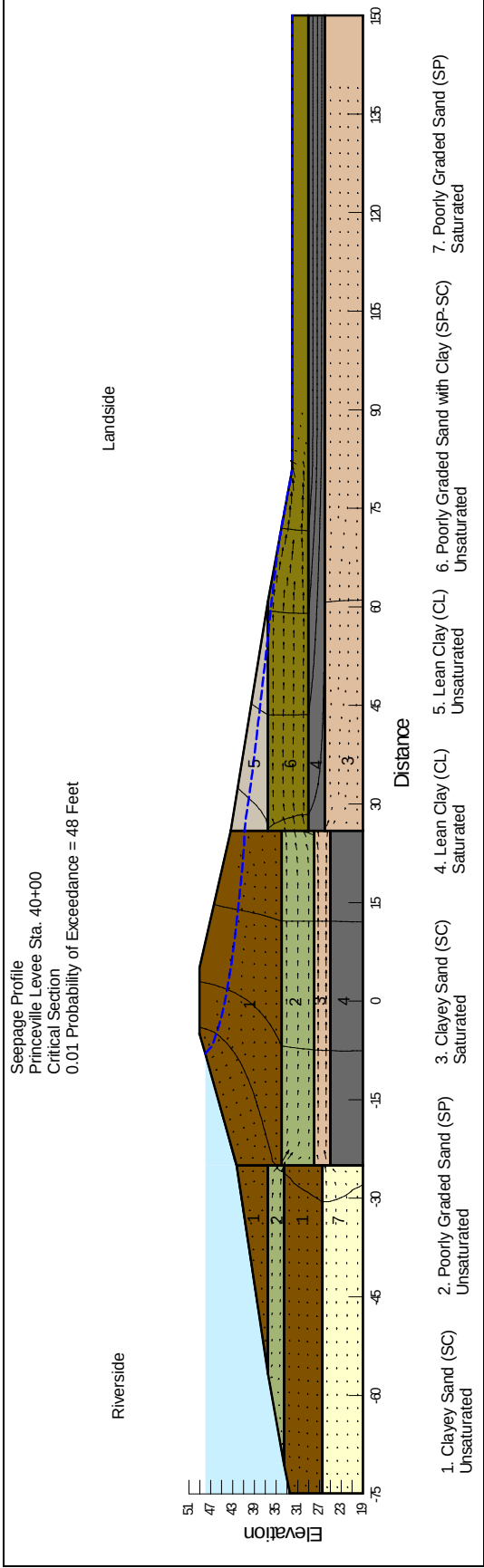


Figure 11. Seepage Profile, Station 40+00, 0.01 Probability of Exceedance, 48 Feet

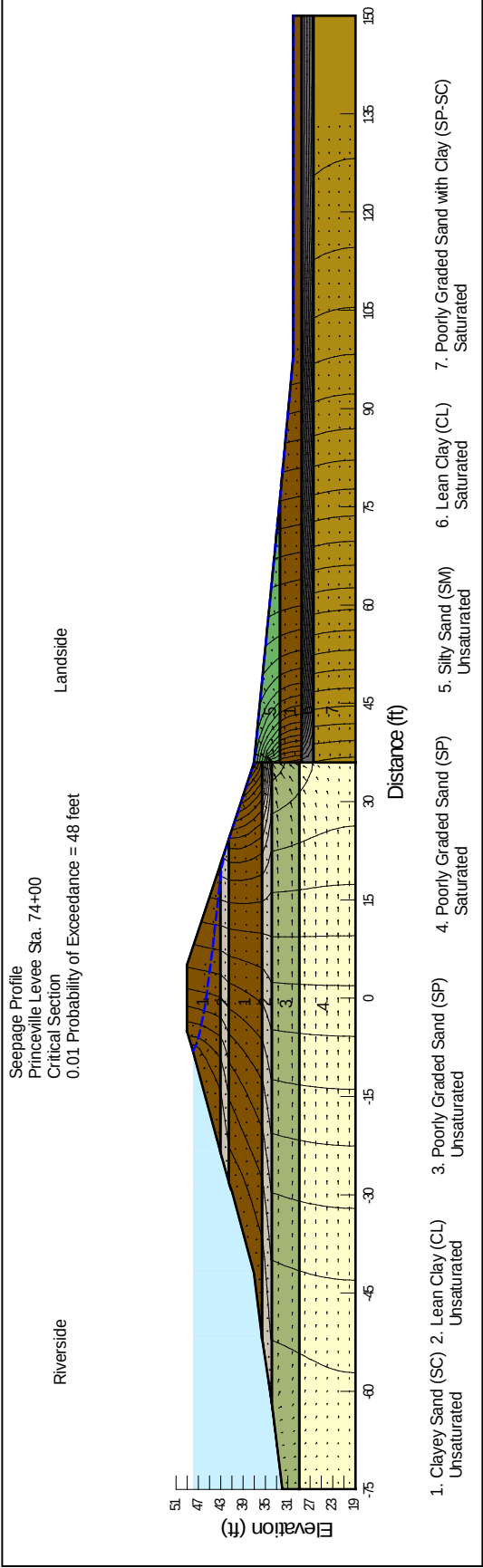


Figure 12. Seepage Profile, Station 74+00, 0.01 Probability of Exceedance, 48 feet

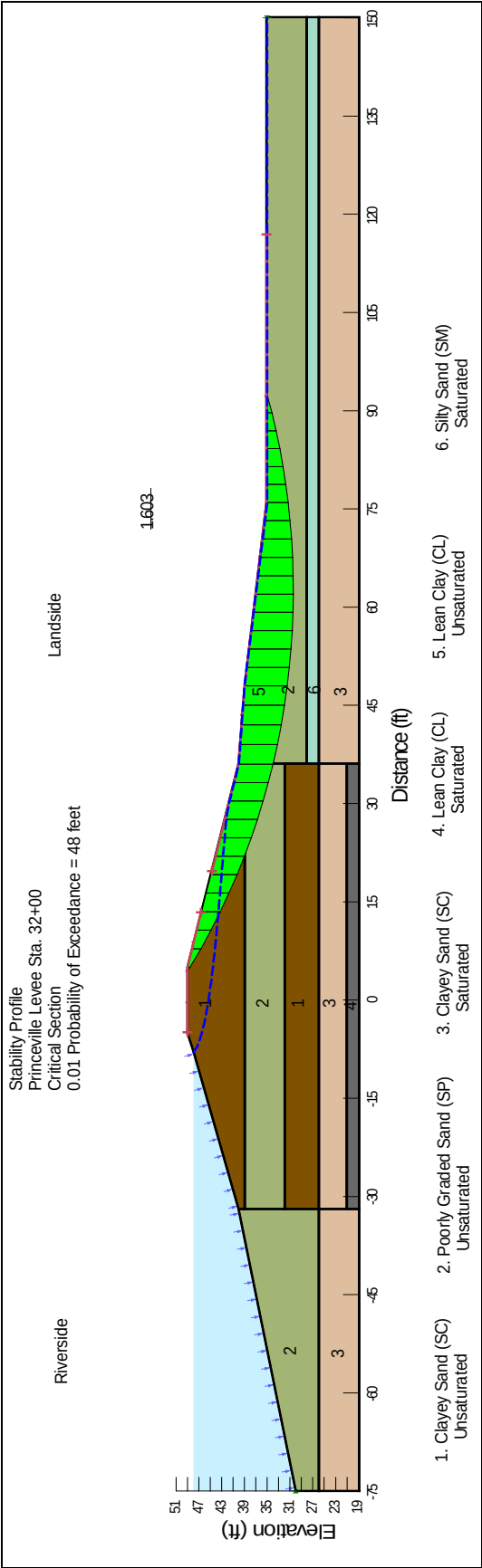


Figure 13. Stability Profile, Station 32+00, 0.01 Probability of Exceedance, 48 feet

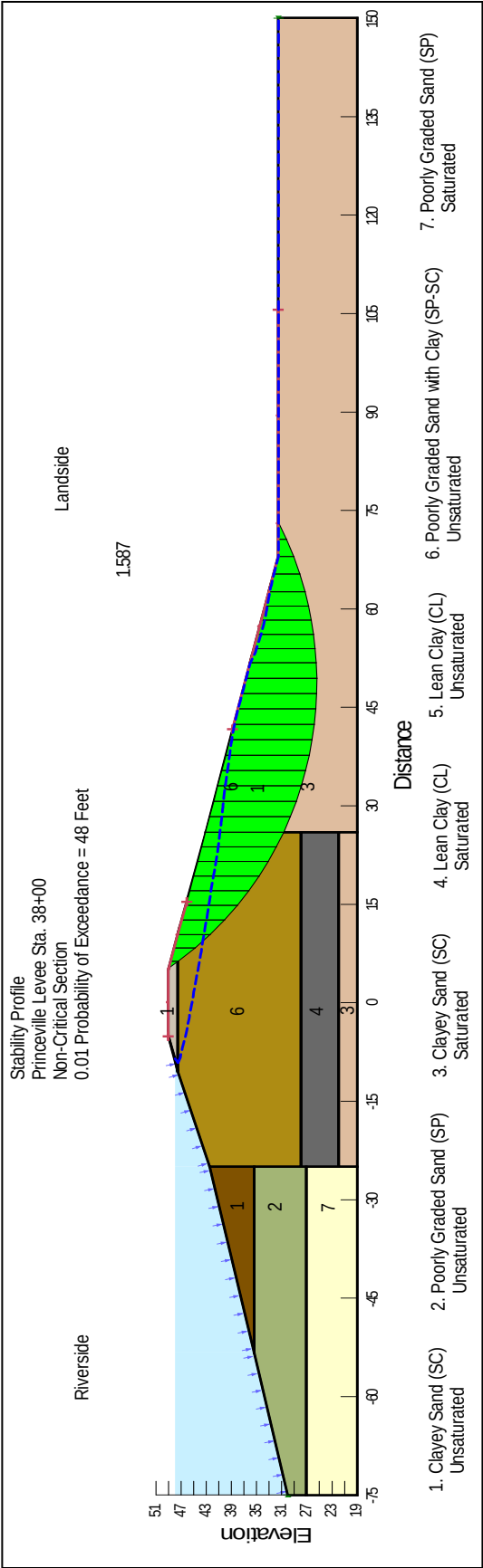


Figure 14. Stability Profile, Station 40+00, 0.01 Probability of Exceedance, 48 Feet

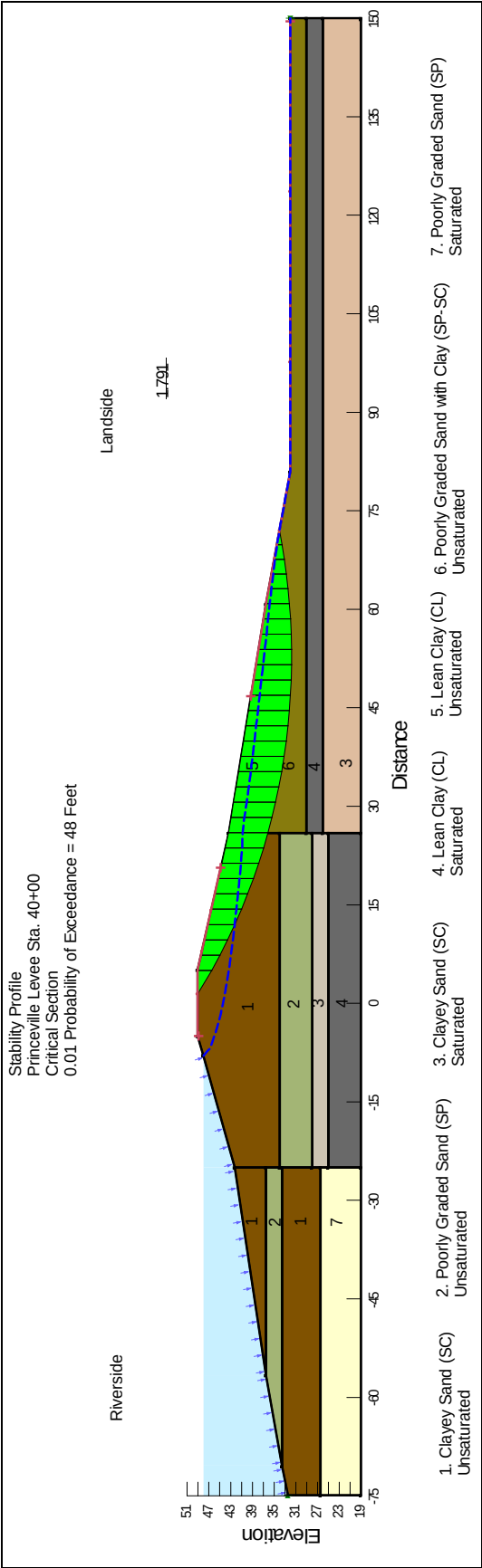


Figure 15. Stability Profile, Station 40+00, 0.01 Probability of Exceedance, 48 Feet

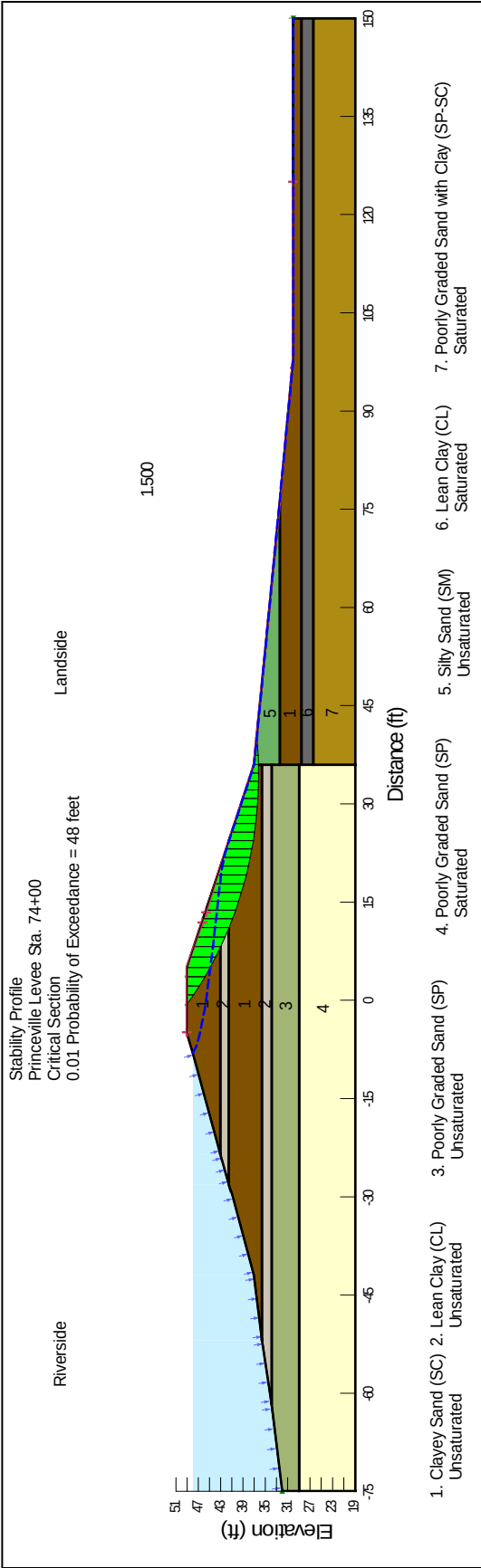


Figure 16. Stability Profile, Station 74+00, 0.01 Probability of Exceedance, 48 feet

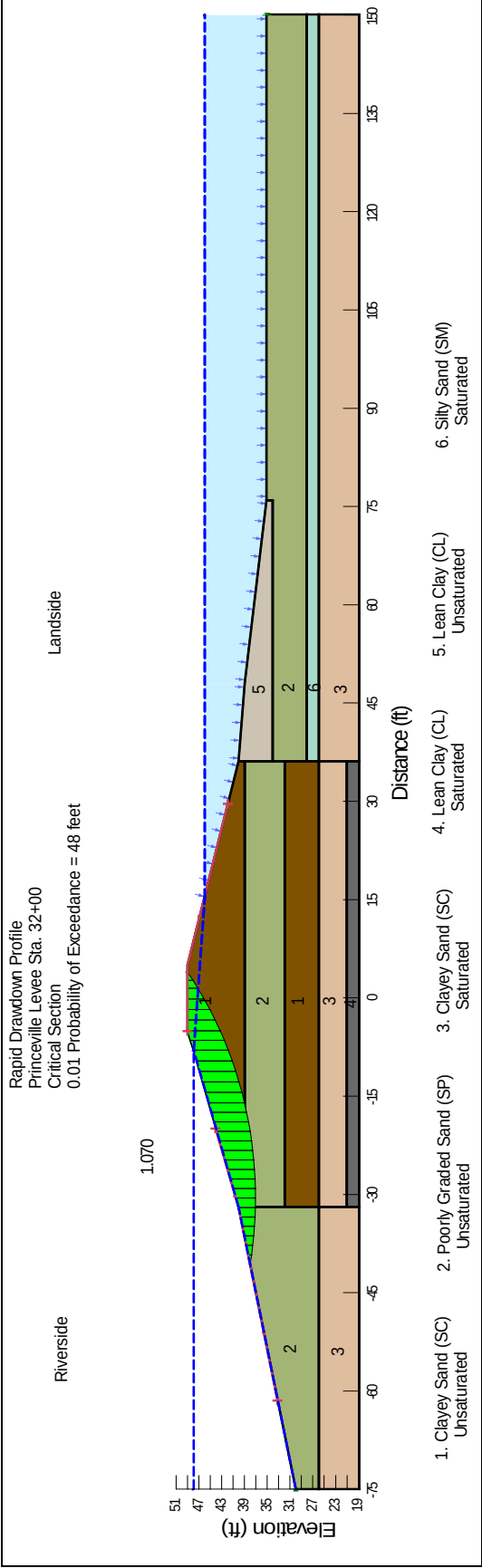


Figure 17. Rapid Drawdown Profile, Station 32+00, 0.01 Probability of Exceedance, 48 feet

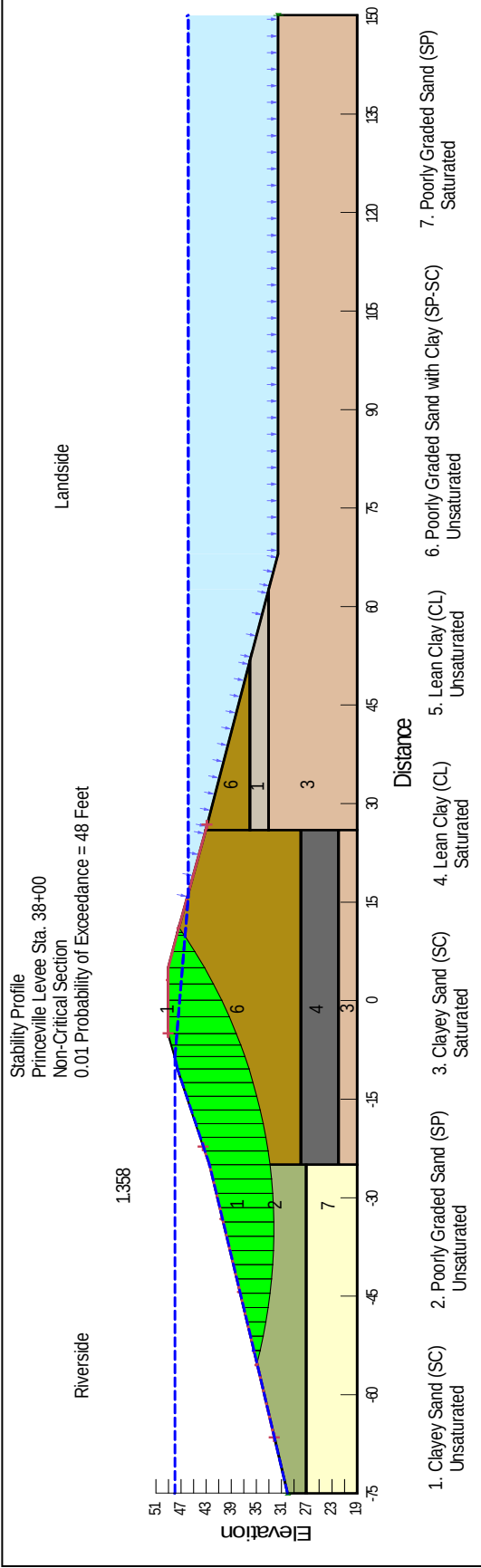


Figure 18. Rapid Drawdown Profile, Station 40+00, 0.01 Probability of Exceedance, 48 Feet

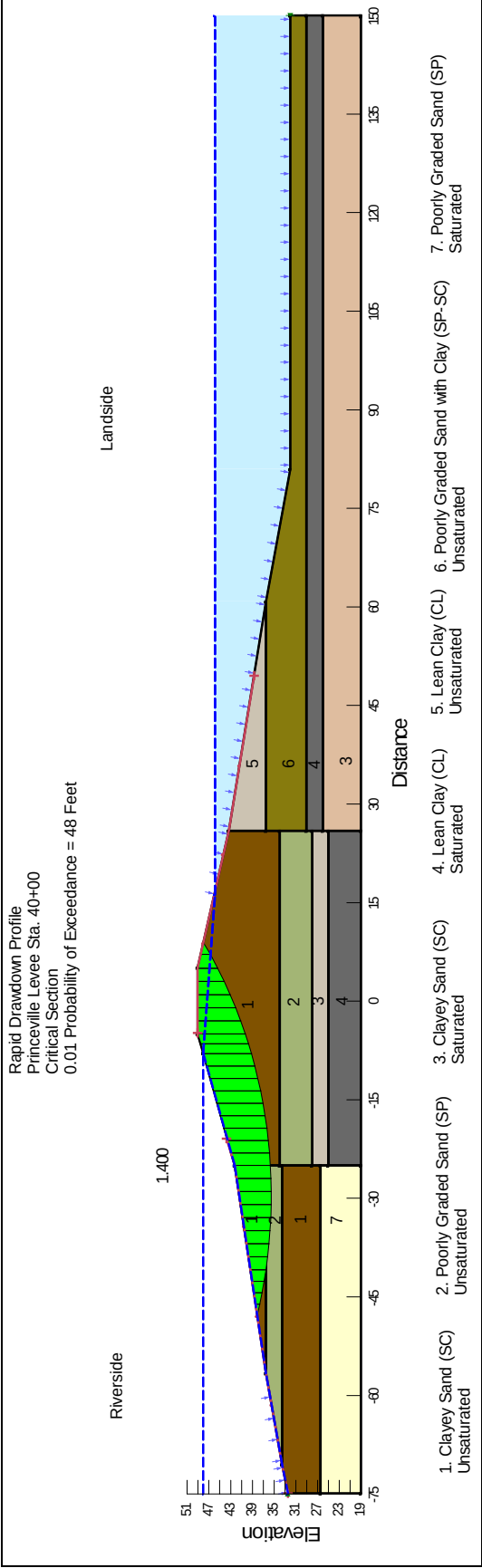


Figure 19 Rapid Drawdown Profile, Station 40.00, 0.01 Probability of Exceedance, 48 Feet

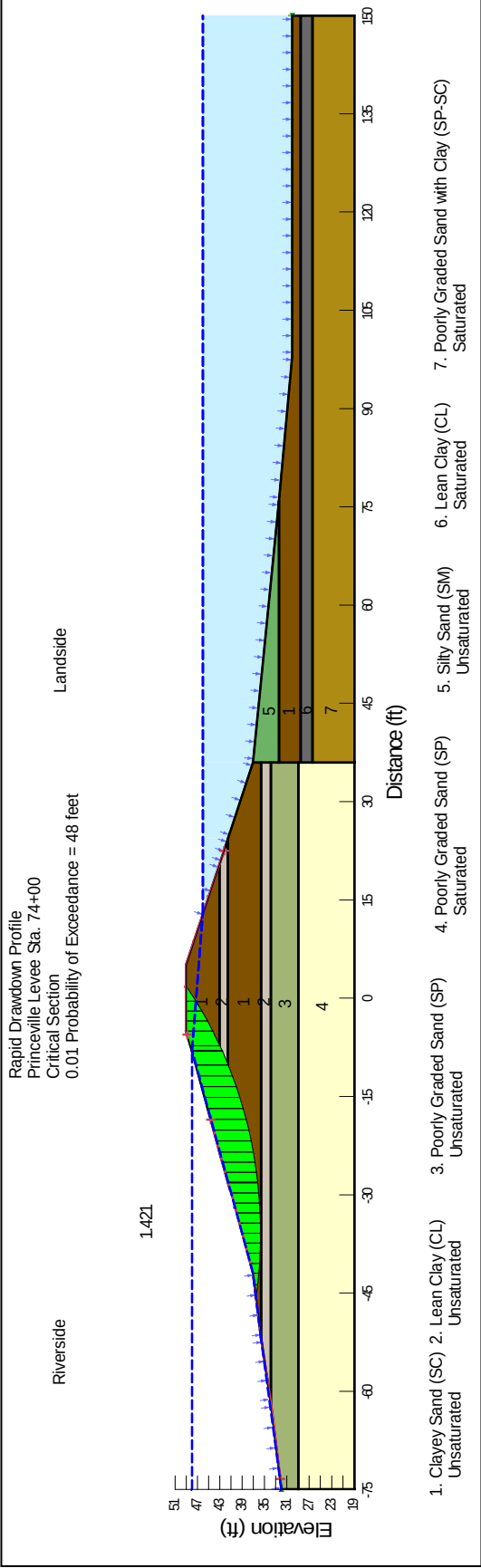


Figure 20. Rapid Drawdown Profile, Station 74+00, 0.01 Probability of Exceedance, 48 feet

Pr(f) Based on Stability Analysis in SLOPEW

PNP/PFP ANALYSIS

Table 1 : Random Variables			
Parameter	Expected Value	Standard Deviation	Coefficient of Variation, %
ϕ° Embankment	28	4	14.29
ϕ° Foundation	5	4	80.00
c embankment	0	200	0.00
c Foundation	1500	200	13.33

F.S. Critical		1.40						
Head		1						
Mean (Expected) Parameters 1 Sigma Deviation	Φ° Embankment		Φ° Foundation	c embankment	c Foundation	Calculated F. S.	Variance Component	Percent of Variance
	28	5.00	1500	0	1500	2.20		
	24	5.00	1500	0	1500	2.40	0.0400000	36.1582
	32	5.00	1500	0	1500	2.00		
	28	1.00	1500	0	1500	1.90	0.0506250	45.763
	28	9.00	1500	0	1500	2.35		
	28	5.00	1500	0	1500	2.10	0.0100000	9.0395
	28	5.00	1500	200	1500	2.30		
	28	5.00	1300	0	1300	2.20	0.0100000	9.0395
	28	5.00	1700	0	1700	2.40		
Total						0.1106250	100	
E[i] =		2.2000	E[ln i] =		0.777157805			
Var[i]=		0.11063	sigma [ln i] =		0.150330005			
sigma[i]=		0.33260						
V(i) =		0.1512						
F.S. Critical		1.40	ln(F.S. crit) =		0.336472237		F(z) =	
							0.96876	
							0.03124	

Figure21. Excel Spreadsheet Data Input

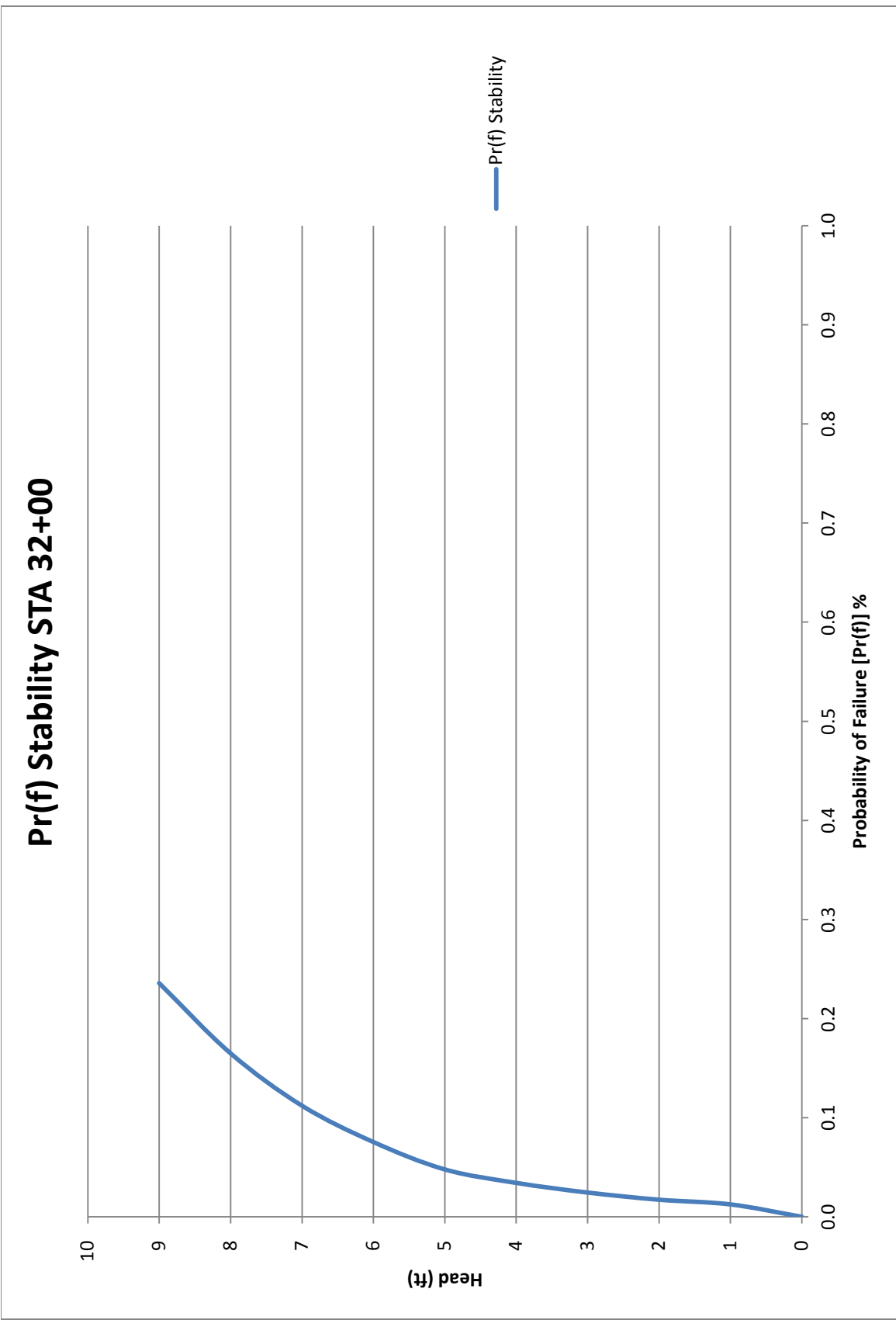


Figure 22. Fragility Curve for Station 32+00

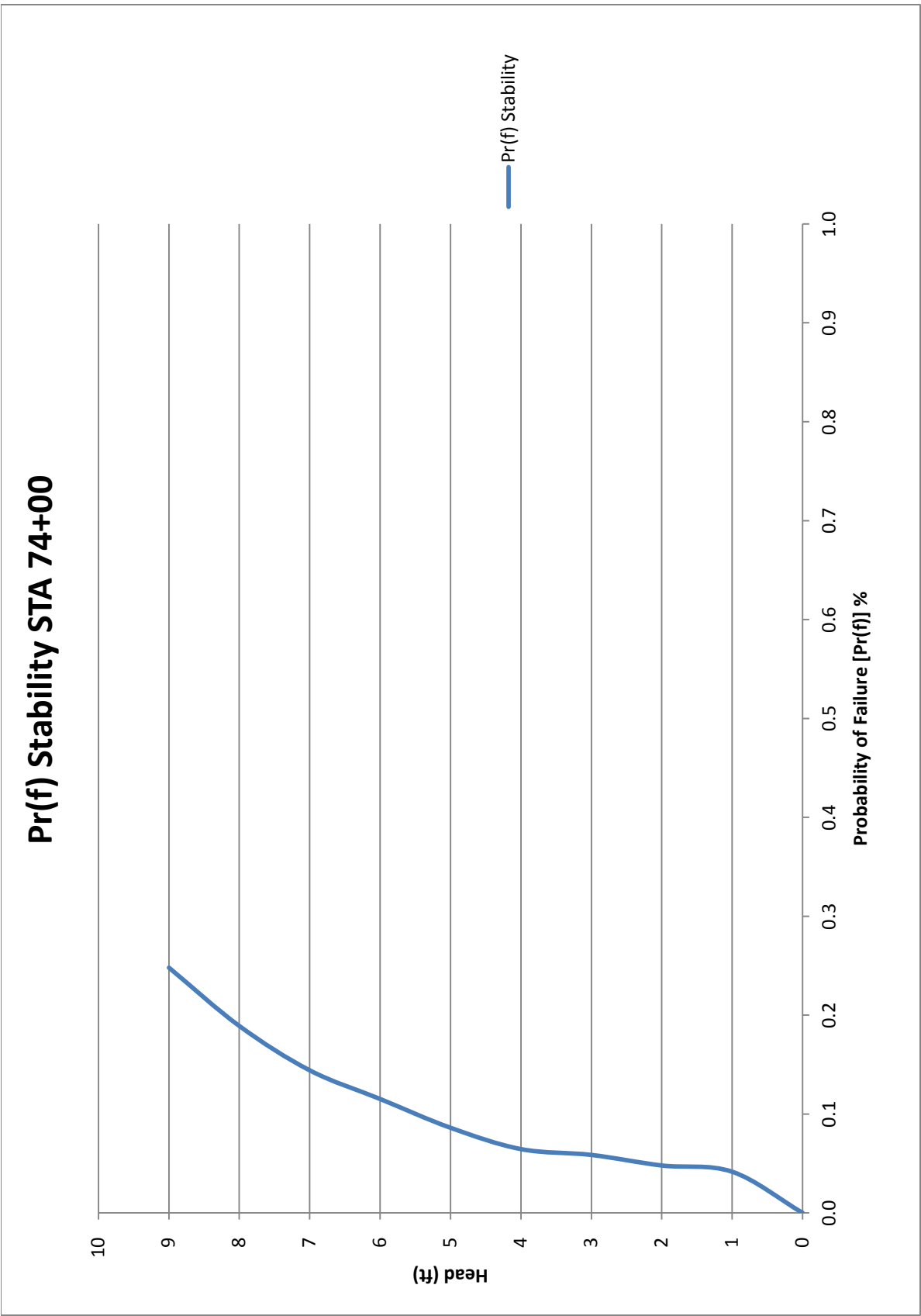


Figure 23. Fragility Curve for Station 74+00.

Attachment 2

Boring Logs

9902-05 (RF-179) 481.112001

HOLE NO. CS-1

DEPARTMENT OF THE ARMY			1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>		
DIVISION <u>SOUTH ATLANTIC</u>			2. LOCATION (Coordinates or Station) <u>TAR RIVER</u>				
INSTALLATION <u>SAVANNAH DISTRICT</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>				
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-1</u>			5. NAME OF DRILLER <u>BURKS</u>				
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK		
10. SIZE AND TYPE OF BIT <u>1 3/8" SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (<u>7</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALCON 314</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>13.0'</u>		16. DATE HOLE STARTED <u>4 MAY 64</u> COMPLETED <u>5 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>11.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
			GRAY SM-SILTY 4 FINE TO TAN MEDIUM SAND		JAR 1		
	5'		SP		2	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	
	10'		POORLY GRADED GRAYELY SAND		3		
	15'				4		
	20'						
	25'		GRAY SM-SILTY FINE SAND		5		
						Soils field classified in accordance with the Unified Soil Classification System.	

9702-05 (RF-179) H&I. 112001

HOLE NO. CS-1A

DEPARTMENT OF THE ARMY			1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-1A</u>			5. NAME OF DRILLER <u>BYRKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
					9. TOTAL DEPTH OF HOLE <u>30.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" SPLIT STICK</u>		11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 30" B.D. # 10-2</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER		16. DATE HOLE STARTED <u>12 JUNE 64</u> COMPLETED <u>12 JUNE 64</u>
17. ELEVATION TOP OF HOLE <u>34.0'</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>William H. Bennett</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM- GRAY SILTY FINE SAND		JAR 1	
	5		SP- GRAY MEDIUM SAND		2	
	10		SM- GRAY SILTY FINE TO MEDIUM SAND		3	
	15		PL- GRAY SANDY CLAY		4	
	20		ML- GRAY SANDY SILT		5	
	25		SM- GRAY SILTY FINE SAND			
	30		Soils field classified in accordance with the Unified Soil Classification System.			
						Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

9702-25 (RF-179) 481.112001

HOLE NO. CS-2

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>		
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>				
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-2</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>				
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			5. NAME OF DRILLER <u>BURNS</u>		7. THICKNESS OF OVER-BURDEN		
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN <u>TDMM or MSL</u>		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 8.5'</u>		16. DATE HOLE STARTED <u>5 MAY 64</u> COMPLETED <u>5 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>42.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>[Signature]</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	5'		GRAY SM-SILTY TAN FINE SAND		1		
	10'		TAN-POORLY GRADED SP GRAVELY SAND		2	W.T. 5 MAY 64	
	15'		SM GRAY SILTY FINE SAND		3		
			CH GRAY - FAT CLAY		4		
	20'		CL GRAY SILTY CLAY		5		
Soils field classified in accordance with the Unified Soil Classification System				Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.			

9902-05(RF-179) 481.112001

HOLE NO. CS-3

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAB RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-3</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>21.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. S&W S-650</u>			11. DATUM FOR ELEVATION SHOWN (BPM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.O. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>4</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION <u>NO</u> GROUND WATER	16. DATE HOLE STARTED <u>5 MAY 64</u> COMPLETED <u>5 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>40.0' LST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Allen H. Merritt</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'				JAR 1	
	5'		SM - TAN SILTY FINE SAND		2.	
	10'					NO GROUND WATER ENCOUNTERED
	15'					
	16'		CH - GRAY FAT CLAY		3.	
	17'		CAVITY - NO SAMPLE			
	20'		CL - GRAY SILTY CLAY		4.	
			Soils field classified in accordance with the Unified Soil Classification System.	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.		

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HOLE NO. CS-4

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAYANNEH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-4</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED			7. THICKNESS OF OVERBURDEN <u> </u>		8. DEPTH DRILLED INTO ROCK <u>30.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 E.D.F. 104</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>4</u> UNDISTURBED <u> </u>			14. TOTAL NO. CORE BOXES <u> </u>		15. ELEVATION GROUND-WATER <u>DEPTH 4.0'</u>	
17. ELEVATION TOP OF HOLE <u>44.0' EST.</u>			19. SIGNATURE OF INSPECTOR <u>Allen H. Merritt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	5'		TAN SM-SILTY FINE TO MEDIUM SAND		1	
	10'		GRAY		2	
	15'					
	20'		GRAY CH-FAT CLAY		3	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.
	25'		GRAY CL-SANDY CLAY		4	Soils field classified in accordance with the Unified Soil Classification System.
	30'					

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HOLE NO. CS-5

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-5</u>			5. NAME OF DRILLER <u>BYRKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN <u>(TBM or MSL)</u>		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAILING 314 20.F 104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN <u>6</u>		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>5.0'</u>	16. DATE HOLE STARTED <u>6 MAY 64</u> COMPLETED <u>6 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>40.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>(Signature)</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			SM - TAN SILTY FINE SAND		JAR!	
			CL - TAN SANDY CLAY		2	
	5'		SC - TAN CLAYEY MEDIUM SAND		3	▼ 6 MAY 64 W.T.
	10'		SM - GRAY SILTY FINE TO MEDIUM SAND W/CLAY BINDER		4	
	15'				5	
	20'					
	25'		CL - SILTY CLAY GRAY SANDY CLAY			
	30'		Soils field classified in accordance with the Unified Soil Classification System.			
					6	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

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HOLE NO. CS-6

DEPARTMENT OF THE ARMY			1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-6</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (<u>TD</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAILING 314</u> <u>RD #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN <u>6</u>			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 11.0'</u>	
17. ELEVATION TOP OF HOLE <u>311.1' ASL</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		16. DATE HOLE STARTED <u>6 MAY 64</u> COMPLETED <u>7 MAY 64</u>	
19. SIGNATURE OF INSPECTOR <u>[Signature]</u>						

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			SM - TAN SILTY FINE TO MEDIUM SAND		JAR1	Soils field classified in accordance with the Unified Soil Classification System.
			SC - TAN CLAYEY SAND		2	
			SP - TAN MEDIUM TO COARSE SAND		3	▼ 6 MAY 64 W.T.
			SM - GRAY SILTY SAND W/CLAY BINDER		4	
			CL - GRAY SILTY CLAY		5	
			TAN SM - SILTY FINE SAND		6	
			GRAY SILTY MEDIUM SAND FROM 27.0'			Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

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HOLE NO. CS-7

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N. C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-7</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPDR</u>			11. DATUM FOR ELEVATION SHOWN (BM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. GROUND GROUND WATER DEPTH <u>13.0'</u>	
16. DATE HOLE STARTED <u>7 MAY 64</u> COMPLETED <u>7 MAY 64</u>						
17. ELEVATION TOP OF HOLE <u>30.0' EST.</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Allen H. McNeill</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE TO MEDIUM SAND		JAR 1	
	5'					
	10'		CL - TAN SILTY CLAY		2	
	15'		SP - TAN SAND WITH OCCASIONAL FINE GRAVEL		3	
	20'		CL - GRAY SANDY CLAY SILTY CLAY		4	
	25'		SM - GRAY SILTY FINE TO MEDIUM SAND		5	
	30'		Soils field classified in accordance with the Unified Soil Classification System.			
						Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

HOLE NO. CS-8

DEPARTMENT OF THE ARMY				1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>				2. LOCATION (Coordinates or Station) <u>TAR RIVER</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>				3. DRILLING AGENCY <u>TARBORO, N.C.</u>			
DRILLING LOG				5. NAME OF DRILLER <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-8</u>				7. THICKNESS OF OVER-BURDEN			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL				8. DEPTH DRILLED INTO ROCK		9. TOTAL DEPTH OF HOLE <u>30.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRBANK 314 C.D. #104</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>12.5'</u>		16. DATE HOLE STARTED <u>7 MAY 64</u> COMPLETED <u>7 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>30.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Allen H. Merritt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	0'		SM - TAN SILTY FINE SAND		JAR 1		
	5'						
	10'		CL - TAN SANDY CLAY		2.		
	15'		SM - SILTY FINE TO MEDIUM SAND WITH SILTY GINGER		3.		
	20'						
	25'		SANDY CLAY CL - GRAY SILTY CLAY		4.		
	30'		SM - SILTY FINE SAND		5.		

Soils field classified in accordance with the Unified Soil Classification System.

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

Blows: 15, 30, 5, 4, 20, 15, 11, 16, 34, 15, 19, 19, 27, 20, 25, 33, 27, 36, 33, 40

HOLE NO. CS-9

DEPARTMENT OF THE ARMY				1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>				2. LOCATION (Coordinates or Station) <u>TAR RIVER</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>				3. DRILLING AGENCY <u>TARBORO, N.C.</u>			
DRILLING LOG				5. NAME OF DRILLER <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-9</u>				7. THICKNESS OF OVER-BURDEN			
6. DIRECTION OF HOLE		DEGREES WITH VERTICAL		8. DEPTH DRILLED INTO ROCK		9. TOTAL DEPTH OF HOLE <u>30.0'</u>	
☒ VERTICAL ☐ INCLINED							
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 9.5'</u>		16. DATE HOLE	
DISTURBED <u>5</u>		UNDISTURBED		STARTED <u>7 MAY 64</u>		COMPLETED <u>8 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>32.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>John H. Merritt</u>			

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			SM- TAN SILTY FINE SAND		JAR1	
	5'					
	10'		FINE TO MEDIUM SM FROM 9.0'			
	15'		Bells field classified in accordance with the Unified Soil Classification System.			
			CH- GRAY FAT CLAY		2	7 MAY 64 W.T.
	20'		SC- GRAY CLAYEY SAND		3	
	25'		SM- GRAY SILTY FINE TO MEDIUM SAND		4	
	30'				5	

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

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HOLE NO. CS-10

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>		1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>		
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>				
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-10</u>		5. NAME OF DRILLER <u>BURKS</u>				
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED		7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>30.0'</u>		
9. TOTAL DEPTH OF HOLE		10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>				
11. DATUM FOR ELEVATION SHOWN (FMS or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 - C.D. #104</u>				
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 12.0'</u>		
16. DATE HOLE STARTED <u>11 MAY 64</u> COMPLETED <u>11 MAY 64</u>		17. ELEVATION TOP OF HOLE <u>30.0' EST.</u>				
18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>William H. Merritt</u>				
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0					
	5'		FINE SM- GRAY AND TAN SILTY FINE SAND		JAR 1	Soils field classified in accordance with the Unified Soil Classification System.
	10'		MEDIUM		2	11 MAY 64 W.T.
	15'		SP- TAN AND GRAY SAND WITH FINE GRAVEL		3	
	20'		CL- TAN AND GRAY SANDY CLAY		4	
	25'		SM- GRAY AND TAN SILTY FINE SAND WITH CLAY SAND		5	
	30'		SILTY FINE SAND		6	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

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HOLE NO. CS-11

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
DRILLING LOG		5. NAME OF DRILLER <u>BURKS</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-11</u>		7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>30.0'</u>	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D.#104</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES	
15. ELEVATION GROUND WATER		16. DATE HOLE STARTED <u>11 MAY 64</u> COMPLETED <u>11 MAY 64</u>			
17. ELEVATION TOP OF HOLE <u>29.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>W. H. Merrill</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
	0'				
	5'		SM-TAN SILTY FINE SAND WITH CLAY BINDER		JAR 1
	10'		FINE SILTY SAND FROM 6.0'		
	15'		SC-TAN CLAYEY SAND		2.
	20'		SM-TAN SILTY MEDIUM SAND		3.
	25'		CL-GRAY SANDY CLAY		4.
	30'		SM-TAN AND GRAY FINE SILTY SAND		5.
REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)					
Soils field classified in accordance with the Unified Soil Classification System.					
W.T. 11 MAY 64					
Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.					

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HOLE NO. CS-12

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-12</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK <u>29.2'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. ELEVATION OF GROUND WATER <u>DEPTH 14.0'</u>	
16. DATE HOLE STARTED <u>12 MAY 64</u> COMPLETED <u>12 MAY 64</u>			17. ELEVATION TOP OF HOLE <u>30.0' EST.</u>			
18. TOTAL CORE RECOVERY FOR BORING (%)			19. SIGNATURE OF INSPECTOR <u>Alison H. Hewitt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE SAND			Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.
	5'					80/0.5' = 80 BLOWS IN FIRST 0.5' FOOT PENETRATED
	10'					
	15'		TAN SILTY MEDIUM SAND			
	20'		CH - GRAY FAT CLAY			
	25'		SP - TAN MEDIUM SAND			
	30'					

HOLE NO. CS-13

DEPARTMENT OF THE ARMY				1. PROJECT FLOOD CONT. DIKE TAR RIVER		HOLE NO. 1 SHEET 1 OF 1	
DIVISION SOUTH ATLANTIC				2. LOCATION (Coordinates or Station) TARBORO, N.E.			
INSTALLATION SAVANNAH DISTRICT				3. DRILLING AGENCY MOBILE DISTRICT			
DRILLING LOG				5. NAME OF DRILLER BURKS			
4. HOLE NO. (As shown on drawing title and file No.) CS-13				7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
6. DIRECTION OF HOLE				9. TOTAL DEPTH OF HOLE 29.3'			
☒ VERTICAL ☐ INCLINED				11. DATUM FOR ELEVATION SHOWN (FM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 314 C.D. #104	
10. SIZE AND TYPE OF BIT 1 3/8" I.D. SPLIT SPOON				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES	
DISTURBED 5 UNDISTURBED				15. ELEVATION GROUND WATER DEPTH 11.0'		16. DATE HOLE	
17. ELEVATION TOP OF HOLE 34.0' EST.				18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR Allen J. Merritt	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	0'		SM - TAN SILTY FINE SAND		JAR 1	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	
	5'		SC - TAN CLAYEY FINE SAND		2		
	10'		SM - TAN SILTY MEDIUM SAND		3		
	15'		CH - GRAY FAT CLAY		4		
	20'		SM - TAN AND GRAY SILTY FINE TO MEDIUM SAND		5		
	25'		Soils field classified in accordance with the Unified Soil Classification System.			89/0.7' = 80 Blows IN FIRST 0.7' Foot PENETRATED	
	30'						

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HOLE NO. CS-14

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
2. LOCATION (Coordinates or Station) <u>TARBORO, N. C.</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-14</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (P or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314</u> <u>RD. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 9.0'</u>	
16. DATE HOLE STARTED <u>12 MAY 64</u> COMPLETED <u>12 MAY 64</u>			17. ELEVATION TOP OF HOLE <u>34.0' EST.</u>			
18. TOTAL CORE RECOVERY FOR BORING (%)			19. SIGNATURE OF INSPECTOR <u>Allen H. Minitt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE SAND		JAR 1	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.
	5'		SC - TAN CLAYEY FINE SAND		2	
	10'		SM - TAN AND GRAY SILTY FINE TO MEDIUM SAND		3	80/0.5' = 80 BLOWS IN FIRST 0.5' FOOT PENETRATED
	15'		CH - GRAY FAT CLAY		4	
	20'		SM - GRAY SILTY FINE TO MEDIUM SAND		5	80/0.5' 80/0.8' 80/0.8'
	25'		Soils field classified in accordance with the Unified Soil Classification System.		6	80 80/0.8' 80/0.8'
	30'					NOTE - HOLE STOPPED SHORT OF 30.0' DUE TO MATERIAL ENCOUNTERED

1902-35(RF-179) 481.112001

HOLE NO. CS-15

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u> DRILLING LOG			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>		
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-15</u>			5. NAME OF DRILLER <u>BURKS</u>				
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK		
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPH 7 SPOON</u>			11. DATUM FOR ELEVATION SHOWN <u>(B.M. or MSL)</u>		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u>		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>REF-4 6.0'</u>		16. DATE HOLE STARTED <u>13 MAY 64</u> COMPLETED <u>13 MAY 64</u>	
17. ELEVATION TOP OF HOLE <u>34.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>CLARENCE H. HENNING</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	0		SM - TAN SILTY FINE SAND		JAR 1		
	5'		SC - TAN CLAYEY FINE SAND		2.		
	10'		SM - TAN FINE SILTY MEDIUM SAND		3.		
	15'		SC - GRAY FAT CLAY		4.		
	20'		SC - GRAY CLAYEY FINE TO MEDIUM SAND		5.		
	25'		SM - GRAY SILTY FINE SAND		6.		
	30'		Soils field classified in accordance with the Unified Soil Classification System.				
						Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	

9902-05 (RE-179) 481 112001

HOLE NO. CS-16

DEPARTMENT OF THE ARMY

DIVISION SOUTH ATLANTIC
INSTALLATION SAVANNAH DISTRICT

DRILLING LOG

1. PROJECT FLOOD CONT. DIKE

SHEET 1 OF 1

2. LOCATION (Coordinates or Station)

TARBORO, N.C.

3. DRILLING AGENCY

MOBILE DISTRICT

4. HOLE NO. (As shown on drawing title and file No.)

CS-16

5. NAME OF DRILLER

BURKS

6. DIRECTION OF HOLE

☒ VERTICAL☐ INCLINED

DEGREES WITH VERTICAL

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

1 3/8" I.D. SPLIT SPOON11. DATUM FOR ELEVATION SHOWN
(~~FEET~~ or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

FALLING 314 C.D. #104

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

DISTURBED

4

UNDISTURBED

14. TOTAL NO. CORE BOXES

15. ~~ELEVATION~~ GROUND WATER

16. DATE HOLE

STARTED

COMPLETED

DEPTH 16.0'13 MAY 6413 MAY 64

17. ELEVATION TOP OF HOLE

33.0' EST.

18. TOTAL CORE RECOVERY FOR BORING (%)

19. SIGNATURE OF INSPECTOR

Allen H. Messitt

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE SAND			Blows: No. of blows from 29 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.
	5'		Soils field classified in accordance with the Unified Soil Classification System.			
	10'					
	15'		CL - TAN SANDY CLAY		2	
	20'		SP - TAN MEDIUM SAND		3	13 MAY 64 W.T.
	25'		SM - GRAY SILTY FINE SAND WITH OCCASIONAL THIN SANDY CLAY LAYERS		4	
	30'		MEDIUM			

Blows

23
29
6
7
17
20
5
9
20
29
20
57
64
38
29
43
51
56
74
64

1702-05 (RF-179) 481.112001

HOLE NO. CS-17

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-17</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>30.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPI. 17 S POON</u>			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. F104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>7</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 140'</u>		
16. DATE HOLE STARTED <u>4 MAY 64</u> COMPLETED <u>14 MAY 64</u>						
17. ELEVATION TOP OF HOLE <u>37.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>J. H. [Signature]</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM - TAN SILTY FINE SAND		1	
	5		Soils field classified in accordance with the Unified Soil Classification System.			
	10		CL - TAN SANDY CLAY		2	
	15		SM - TAN SILTY FINE SAND WITH CLAY BINDER		3	
	20		SILTY MEDIUM SAND		4	
	25		SC - GRAY CLAYEY FINE SAND		5	
	30		SM - GRAY SILTY FINE TO MEDIUM SAND		6	
	35		CL - GRAY SANDY CLAY		7	
	40					
	45					
	50					
	55					
	60					
	65					
	70					
	75					
	80					
	85					
	90					
	95					
	100					

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

9902-05 (RF-179) 481.112001

HOLE NO. CS-18

DEPARTMENT OF THE ARMY			1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-18</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>4</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER	
17. ELEVATION TOP OF HOLE <u>28.0' EST.</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		16. DATE HOLE STARTED <u>14 MAY 64</u> COMPLETED <u>14 MAY 64</u>	
19. SIGNATURE OF INSPECTOR <u>[Signature]</u>						

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM- TAN SILTY FINE SAND WITH CLAY BINDER		JAR 1	
	5'					
	10'		CL- TAN SANDY CLAY		2	
	15'		SP- GRAY MEDIUM SAND		3	
	20'		CH- GRAY FAT CLAY		4	
	25'		Soils field classified in accordance with the Unified Soil Classification System.			

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

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HOLE NO. CS-19

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u> DRILLING LOG		1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>		
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>				
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-19</u>		5. NAME OF DRILLER <u>BURKS</u>				
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED		7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK		
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRBANKS 314 C.D. #104</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u>		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 14.0'</u>		
17. ELEVATION TOP OF HOLE <u>36.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Allen H. Merritt</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM- TAN SILTY FINE SAND		JAR 1	
	5		WITH CLAY BINDER		2	
	10		CL- TAN SANDY CLAY		3	
	15		SILTY CLAY		4	
	15		SM- TAN AND GRAY SILTY FINE TO MEDIUM SAND		5	18 MAY 64
	20		GRAY CH- FAT CLAY		6	NOTE- AMOUNT OF WATER VERY SMALL

Soils field classified in accordance with the Unified Soil Classification System.

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

9902-05 (RF-179) 481.112001

HOLE NO. CS-20

DEPARTMENT OF THE ARMY
DIVISION SOUTH ATLANTIC
INSTALLATION SAVANNAH DISTRICT

DRILLING LOG

4. HOLE NO. (As shown on drawing title and file No.)

CS-19

1. PROJECT FLOOD CONT. DIKE

TAR RIVER

SHEET 1 OF 1

2. LOCATION (Coordinates or Station)

TARBORO, N.C.

3. DRILLING AGENCY

MOBILE DISTRICT

5. NAME OF DRILLER

BURKS

6. DIRECTION OF HOLE

☒ VERTICAL

☐ INCLINED

DEGREES WITH VERTICAL

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

25.5'

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN

(MSL or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

1 3/8" I.D. SPLIT SPOON

FALLING 314 C.D. #104

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

14. TOTAL NO. CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE

DISTURBED

5

UNDISTURBED

STARTED

COMPLETED

DEPTH 7.0'

18 MAY 64

18 MAY 64

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING (%)

19. SIGNATURE OF INSPECTOR

44.0' EST.

Allen H. McNeill

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	BLOWS
	0		SM- TAN SILTY FINE SAND W/ CLAY BINDER		JAR 1.		11
					2.		22
	5'		SC- TAN CLAYEY FINE SAND				16
					3		26
						▼ 18 MAY 64	24
	10'		SP/SM TAN AND GRAY SILTY FINE TO MEDIUM SAND, SPLAYERS		4.	W.T.	16
							14
	15'		SP- GRAY MEDIUM TO COARSE SAND				28
							32
							18
							22
	20'		SM- GRAY SILTY FINE TO MEDIUM SAND		5.		20
							24
							22
							32
	25'						34
							37
			Soils field classified in accordance with the Unified Soil Classification System.			Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	

9902-05 (RF-179) 48L112031

HOLE NO. CS-21

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>	
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-21</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			5. NAME OF DRILLER <u>BURKS</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAILING 314 P.E. # 124</u>			9. TOTAL DEPTH OF HOLE <u>25.5'</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED			14. TOTAL NO. CORE BOXES	
15. ELEVATION GROUND WATER DEPTH <u>75'</u>			16. DATE HOLE STARTED <u>19 MAY 64</u> COMPLETED <u>19 MAY 64</u>	
17. ELEVATION TOP OF HOLE			18. TOTAL CORE RECOVERY FOR BORING (%)	
19. SIGNATURE OF INSPECTOR <u>William H. Merritt</u>				

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		CL - TAN SANDY CLAY		JAR 1	
	5		SILTY CLAY		2	
	10		SP - GRAY MEDIUM SAND		3	 19 MAY 64 W. T.
	15		CL - GRAY SANDY CLAY		4	
	20		SM - GRAY SILTY FINE TO MEDIUM SAND		5	
	25		Soils field classified in accordance with the Unified Soil Classification System.			Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

9902-05 (RF-179) 481.112001

HOLE NO. CS-23

DEPARTMENT OF THE ARMY			1. PROJECT <u>FLOOD CONT DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>			2. LOCATION (Coordinates or Station) <u>TARBORO, N.E.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-23</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8 I.D. S&W 17 S&W</u>			11. DATUM FOR ELEVATION SHOWN (<u>FBM</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER	
DISTURBED <u>6</u> UNDISTURBED			16. DATE HOLE STARTED <u>20 MAY 64</u> COMPLETED <u>20 MAY 64</u>			
17. ELEVATION TOP OF HOLE <u>36.0' EST.</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>William H. Merrill</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE SAND		JAR 1	
	5'					
	10'		SLIGHT TRACE OF CLAY			
	15'		Soils field classified in accordance with the Unified Soil Classification System.		2	▼ 20 MAY 64 W.T.
	20'		CL - TAN SANDY CLAY		3	
	25'		SM - TAN AND GRAY SILTY FINE SAND WITH OCCASIONAL THIN SC LAYER.		4	
	30'		GRAY SILTY MEDIUM SAND		5	Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.
			CL - GRAY SANDY CLAY		6	

9902-05 (RF-179) 481.112031

HOLE NO. CS-24

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-24</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>30.0'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAILING 314</u> <u>2.0" = 104</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>4</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPT 12.0'</u>		
16. DATE HOLE STARTED <u>20 MAY 64</u> COMPLETED <u>21 MAY 64</u>		19. SIGNATURE OF INSPECTOR <u>John H. Mearns</u>				
17. ELEVATION TOP OF HOLE <u>?</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM - SILTY FINE SAND		JAR	
	5		TAN			
	10		SC - TAN CLAYEY SAND	2		
	15		SM SILTY FINE SAND			
	20		TAN	3		
	25		Soils field classified in accordance with the Unified Soil Classification System.			
	30		GRAY SILTY MEDIUM SAND	4		

Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.

9932-25 (REF-179) 481.112001

HOLE NO. CS-25

DEPARTMENT OF THE ARMY

DIVISION SOUTH ATLANTIC
INSTALLATION SAVANNAH DISTRICT

DRILLING LOG

1. PROJECT FLOOD CONT. DIKE
TAR RIVERSHEET 1 OF 1

2. LOCATION (Coordinates or Station)

TARBORO, N.C.

3. DRILLING AGENCY

MOBILE DISTRICT

4. HOLE NO. (As shown on drawing title and file No.)

CS-25

5. NAME OF DRILLER

BURKS

6. DIRECTION OF HOLE

☒ VERTICAL☐ INCLINEDDEGREES WITH
VERTICAL7. THICKNESS OF OVER-
BURDEN8. DEPTH DRILLED INTO
ROCK

9. TOTAL DEPTH OF HOLE

25.5'

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN
(TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

1 3/8" I.D. SPLIT SPOONFALLING 314 C.D. #104

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

14. TOTAL NO. CORE
BOXES15. ELEVATION
GROUND WATER

16. DATE HOLE

DISTURBED

UNDISTURBED

DEPTH 9.0'

STARTED

COMPLETED

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING (%)

19. SIGNATURE OF INSPECTOR

33.0' EST.Clifford A. Williams

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV- ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM-TAN			
	5'		SILTY FINE SAND		JAR 1	
	10'				2	
	15'		Soils field classified in accordance with the Unified Soil Classifi- cation System.			Blows: No. of blows from 140# hammer falling 30" required to drive split- spoon 1' after penetrat- ing 1/2 foot into soil.
	20'		SILTY FINE TO MEDIUM SAND		3	
	25'		SILTY MEDIUM SAND		4	

7. 0
13. 0
10. 0
10. 5
8. 0
8. 0
8. 10
16. 0
15. 0
15. 15
10. 15
26. 0
30. 0
36. 20
46. 0
52. 0
80. 25

DEPARTMENT OF THE ARMY				HOLE NO. <u>CS-26</u>		
DIVISION <u>SOUTH ATLANTIC</u>				SHEET <u>1</u> OF <u>1</u>		
INSTALLATION <u>SAVANNAH DISTRICT</u>				2. LOCATION (Coordinates or Station) <u>TARBORO, N. C.</u>		
DRILLING LOG				3. DRILLING AGENCY <u>MOBILE DISTRICT</u>		
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-26</u>				5. NAME OF DRILLER <u>BURKS</u>		
6. DIRECTION OF HOLE				7. THICKNESS OF OVER-BURDEN		
☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL				8. DEPTH DRILLED INTO ROCK <u>25.5'</u>		
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAILING 314 B.D. #104</u>		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER		
DISTURBED <u>1</u>		UNDISTURBED		16. DATE HOLE STARTED <u>21 MAY 64</u> COMPLETED <u>21 MAY 64</u>		
17. ELEVATION TOP OF HOLE <u>35.0' FST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Clarence H. Merrill</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SM -			
	5'		SILTY FINE SAND		JAR 1	
	10'		TAN		2.	▼ 21 MAY 64 W.T.
	15'		WITH CLAY BINDER		3.	
	20'		SILTY MEDIUM SAND		4.	
	25'		GRAY			
Soils field classified in accordance with the Unified Soil Classification System.				Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.		

HOLE NO. CS-27

DEPARTMENT OF THE ARMY				1. PROJECT		SHEET	
DIVISION				2. LOCATION (Coordinates or Station)		OF	
INSTALLATION				3. DRILLING AGENCY		1	
DRILLING LOG 4. HOLE NO. (As shown on drawing title and file No.) CS-27				5. NAME OF DRILLER BURKS			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED				7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT 1 3/8" I.D. SPLIT SPOON				11. DATUM FOR ELEVATION SHOWN (or MSL)		9. TOTAL DEPTH OF HOLE 32.0'	
12. MANUFACTURER'S DESIGNATION OF DRILL FALLING 314 C.D. #104							
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED 4 UNDISTURBED				14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH 12.0'	
16. DATE HOLE STARTED 22 MAY 64 COMPLETED 22 MAY 64							
17. ELEVATION TOP OF HOLE 32.0' EST.				18. TOTAL CORE RECOVERY FOR BORING (%)			
19. SIGNATURE OF INSPECTOR William H. M...							
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	
	0		SM-		JAR 1		
	5		SILTY FINE SAND		2		
	10		THIN		3		
	15				4		
	20		Soils field classified in accordance with the Unified Soil Classification System.			22 MAY 64 W.T.	
	25		GRAY SILTY MEDIUM SAND			Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	
	30						

9902-55 (RF-179) 481.112001

HOLE NO. CS-28

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CONTROL DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>THRB035, N.E.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
DRILLING LOG		5. NAME OF DRILLER <u>BURKS</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-28</u>		7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL		9. TOTAL DEPTH OF HOLE <u>30.0'</u>			
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPIN</u>		11. DATUM FOR ELEVATION SHOWN (<u>FROM</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. 104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>15.5'</u>	
16. DATE HOLE STARTED <u>22 MAY 64</u> COMPLETED <u>22 MAY 64</u>					
17. ELEVATION TOP OF HOLE <u>31.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>[Signature]</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
	0'		SM- TAN SILTY FINE SAND		
	5'		SC- TAN CLAYEY SAND		
	10'		SM- TAN SILTY FINE SAND		
	15'		Soils field classified in accordance with the Unified Soil Classification System.		
	20'		SILTY MEDIUM SAND		
	25'		SP- GRAY MEDIUM SAND		
	30'				
				Blows: No. of blows from 140# hammer falling 30" required to drive split-spoon 1' after penetrating 1/2 foot into soil.	

9702-05 (RF-179) 481.112001

HOLE NO. CS-30

DEPARTMENT OF THE ARMY

DIVISION SOUTH ATLANTIC
INSTALLATION SAVANNAH DISTRICT

DRILLING LOG

1. PROJECT FLOOD CONT. DIKE
TAR RIVER

SHEET 1 OF 1

2. LOCATION (Coordinates or Station)

TARBORO, N.C.

3. DRILLING AGENCY

MOBILE DISTRICT

5. NAME OF DRILLER

BURKS

4. HOLE NO. (As shown on drawing title and file No.)

CS-30

6. DIRECTION OF HOLE

☒ VERTICAL☐ INCLINEDDEGREES WITH
VERTICAL7. THICKNESS OF OVER-
BURDEN8. DEPTH DRILLED INTO
ROCK

9. TOTAL DEPTH OF HOLE

30.0'

10. SIZE AND TYPE OF BIT

1 3/8" I.D. SPLIT SPOON11. DATUM FOR ELEVATION SHOWN
(FBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

FALLING 314 E.D. #104

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

DISTURBED

6

UNDISTURBED

14. TOTAL NO. CORE
BOXES15. ELEVATION
GROUND WATER

16. DATE HOLE

STARTED

26 MAY 64

COMPLETED

26 MAY 64

17. ELEVATION TOP OF HOLE

280' EST.

18. TOTAL CORE RECOVERY FOR BORING (%)

19. SIGNATURE OF INSPECTOR

Allen H. Tinsmith

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV- ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		CL - TAN SANDY CLAY			
	5		SC - TAN CLAYEY SAND		JAR 1	
	10		SM - TAN SILTY FINE SAND		2	
	15		SP - GRAY SILTY MEDIUM SAND		3	26 MAY 64 W.T.
	20		Soils field classified in accordance with the Unified Soil Classifi- cation System.			Blows: No. of blows from 140# hammer falling 30" required to drive split- spoon 1' after penetrat- ing 1/2 foot into soil.
	25		SP - GRAY MEDIUM SAND		4	
	30		CH - GRAY FAT CLAY		5	
			SM - GRAY SILTY FINE SAND		6	

9902-05 (RF-179) 481.112.001

HOLE NO. CS-33

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CONTROL</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
DRILLING LOG		5. NAME OF DRILLER <u>BYRKS</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-33</u>		7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL		9. TOTAL DEPTH OF HOLE <u>25.0'</u>			
10. SIZE AND TYPE OF BIT <u>1 3/8" SPLIT POINT</u>		11. DATUM FOR ELEVATION SHOWN (<u>FBM</u> or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 B.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>15.0'</u>	
16. DATE HOLE STARTED <u>15 JUNE 64</u> COMPLETED <u>15 JUNE 64</u>					
17. ELEVATION TOP OF HOLE <u>39.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>[Signature]</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
	0'		SM- TAN SILTY SAND		1.
	5'		SP- TAN MEDIUM SAND		2.
	10'				
	15'		GRAY SANDY CLAY		3.
	20'		GRAY AND TAN SILTY CLAY		4.
	25'		GRAY AND TAN SANDY CLAY		5.
			Soils field classified in accordance with the Unified Soil Classification System.		
			BLOWS PER FOOT NUMBER REQUIRED TO DRIVE 1 1/2" I.D. SPT. SPT. W/140 LB. HAMMER FALLING 30"		

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HOLE NO. CS-34

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAYANVAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-34</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE <u>30.0'</u>			10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPON</u>			
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)			12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. ESTIMATED GROUND WATER DEPTH <u>3.0'</u>	
16. DATE HOLE STARTED <u>15 JUNE 64</u> COMPLETED <u>16 JUNE 64</u>			17. ELEVATION TOP OF HOLE <u>33.0' EST.</u>			
18. TOTAL CORE RECOVERY FOR BORING (%)			19. SIGNATURE OF INSPECTOR <u>Allen H. Menitt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			OL/SM - BLACK ORGANIC SILT W/ SILTY SAND		JAR 1	
	5'		SP - GRAY MEDIUM SAND Soils field classified in accordance with the Unified Soil Classification System		2	15 JUNE 64 W.T.
	10'		CH - GRAY FAT CLAY		3	
	15'		CL GRAY SILTY CLAY SANDY CLAY			
	20'		SM - GRAY SILTY FINE SAND WITH CLAY BINDER			
	25'					
	30'					

BLOWS PER FOOT

4. NUMBER REQUIRED TO DRIVE 1 1/2" I.D. SPLIT SPON WITH 140 LB HAMMER FALLING 30"

80/0.9' = 89

6. BLOWS IN FIRST 0.9' PENETRATED

4.
10.
15.
20.
25.
30.
35.
40.
45.
50.
55.
60.
65.
70.
75.
80.
85.
90.
95.
100.

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HOLE NO. CS-35

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>TARBORO, N. C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-35</u>		5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL		7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE <u>25.5'</u>					
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPHITSPOON</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRBANKS 314 C.D. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u> UNDISTURBED		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER DEPTH <u>9.5'</u>	
16. DATE HOLE STARTED <u>16 JUNE 64</u> COMPLETED <u>16 JUNE 64</u>					
17. ELEVATION TOP OF HOLE <u>39.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>Glenn H. Niccoli</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
	0		GRAY SM - SILTY FINE SAND		JAR 1
	5		TAN CL - TAN SANDY CLAY		2
	10		SM - TAN SILTY FINE SAND		3
	15		SC - TAN CLAYEY SAND		4
	20		SHAND - MEDIUM TO COARSE WITH SMALL AMOUNT FINE GRAVEL		5
	25		CL - GRAY SILTY CLAY		6
			Soils field classified in accordance with the Unified Soil Classification System.	BLOWS PER FOOT NUMBER REQUIRED TO DRIVE 1 1/2" I.D. SPHITSPOON W/140 LB. HAMMER FAIRBANKS 30"	

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HOLE NO. CS-36

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CON. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
DRILLING LOG		4. NAME OF DRILLER <u>BURKS</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-36 NEW LOCATION</u>		5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE		7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
☒ VERTICAL ☐ INCLINED				9. TOTAL DEPTH OF HOLE	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPURSAW</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 3D #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER	
DISTURBED <u>5</u>		UNDISTURBED		16. DATE HOLE	
17. ELEVATION TOP OF HOLE <u>42.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>William H. Merritt</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
	0		SM- TAN SILTY FINE SAND		JAR 1
	5		SC- TAN CLAYEY SAND		2
	10		SP- TAN MEDIUM SAND		3
	15		SC- GRAY CLAYEY SAND		4
	20		SM- GRAY SILTY FINE SAND WITH CLAY BINDER		5
			Soils field classified in accordance with the Unified Soil Classification System.	BLOWS PER FOOT: Number required to drive 1 1/2" ID splitspoon w/140 lb. hammer falling 30".	

BLOWS

7.
12.
10.
11.5
10.
12.
8.
19.
31.
42.
42.
48.
38.
46.20

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HOLE NO. CS-37

DEPARTMENT OF THE ARMY		1. PROJECT <u>FLOOD CONT. DIKE</u>		SHEET <u>1</u> OF <u>1</u>	
DIVISION <u>SOUTH ATLANTIC</u>		2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
INSTALLATION <u>SAVANNAH DISTRICT</u>		3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-37</u>		5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED		7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>25.5'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>		11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or <u>MSL</u>)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 30" C.O. #104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 4.0'</u>	
DISTURBED <u>5</u>		UNDISTURBED		16. DATE HOLE STARTED <u>16 JUNE 64</u> COMPLETED <u>17 JUNE 64</u>	
17. ELEVATION TOP OF HOLE <u>37.0' EST.</u>		18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>[Signature]</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.
			SM- GRAY SILTY FINE TO MEDIUM SAND		1
	5'		SP- GRAY MEDIUM TO COARSE SAND		2
	10'		SC- GRAY CLAYEY SAND		3
	15'		CL- GRAY SILTY CLAY		4
	20'		CH- GRAY AND BROWN FAT CLAY WITH OCCASIONAL THIN SILT LAYER.		5
	25'				
			Soils field classified in accordance with the Unified Soil Classification System.	BLOWS PER FOOT NUMBER REQUIRED TO DRIVE 1 1/2" I.D. SPLIT-SPOON W/ 140 LB. HAMMER FALLING 30"	

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HOLE NO. CS-38

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SARASOTA DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DIKE</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-38</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK <u>25.5'</u>	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. # 104</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>6</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>DEPTH 6.0'</u>	
16. DATE HOLE STARTED <u>17 JUNE 64</u> COMPLETED <u>17 JUNE 64</u>			17. ELEVATION TOP OF HOLE <u>40.0' EST.</u>			
18. TOTAL CORE RECOVERY FOR BORING (%)			19. SIGNATURE OF INSPECTOR <u>Robert H. McNeill</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		GRAY SM-SILTY		JAR 1	
	5'		TAN FINE SAND			
			GRAY			
			SP- GRAY MEDIUM TO COARSE SAND		2	17 JUNE 64 W.T.
	10'		SC- GRAY CLAYEY FINE SAND		3	80/0.7' = 80 BLOWS IN FIRST 0.7' PENETRATED
	15'		CL- GRAY SANDY CLAY		4	
	20'		ML- GRAY AND BROWN CLAYEY SILT WITH FINE SAND		5	
	25'		CH- GRAY FAT CLAY		6	
Soils field classified in accordance with the Unified Soil Classification System,				BLOWS PER FOOT NUMBER REQUIRED TO DRIVE 1 1/2" I.D. SPLIT-SPOON W/140 LB. HAMMER FALLING 31"		

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HOLE NO. CS-39

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT. DITCH</u> <u>TAR RIVER</u>		SHEET <u>1</u> OF <u>1</u>	
DRILLING LOG			2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-39</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
10. SIZE AND TYPE OF BIT <u>1 3/8" I.D. SPLIT SPOON</u>			11. DATUM FOR ELEVATION SHOWN <u>(F.M. or MSL)</u>		9. TOTAL DEPTH OF HOLE <u>21.0'</u>	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u>5</u> UNDISTURBED			14. TOTAL NO. CORE BOXES		12. MANUFACTURER'S DESIGNATION OF DRILL <u>FAIRING 314 C.D. #104</u>	
15. ELEVATION GROUND WATER <u>DEPTH 7.5'</u>			16. DATE HOLE STARTED <u>18 JUNE 64</u> COMPLETED <u>18 JUNE 64</u>			
17. ELEVATION TOP OF HOLE <u>39.0' F.S.T.</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR <u>[Signature]</u>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM- BLACK SILTY FINE SAND		JAR 1	
	5'		OL- TAN ORGANIC SILT		2	
	10'		SM- GRAY SILTY SAND WITH 3" BINDER TRASH OF SHILLS		3	18 JUNE 64 N.T.
	15'		SILTY SAND WITH CLAY BINDER		4	
	20'				5	
			Soils field classified in accordance with the Unified Soil Classification System.	BLOWS PER FOOT: Number required to drive 1 1/2" ID split spoon w/140 lb. hammer falling 30".		

9902-05 (RF-179) 481.112001

HOLE NO. CS-40

DEPARTMENT OF THE ARMY DIVISION <u>SOUTH ATLANTIC</u> INSTALLATION <u>SAVANNAH DISTRICT</u>			1. PROJECT <u>FLOOD CONT DIKE</u> <u>TARRIVER</u>		SHEET <u>1</u> OF <u>1</u>	
2. LOCATION (Coordinates or Station) <u>TARBORO, N.C.</u>			3. DRILLING AGENCY <u>MOBILE DISTRICT</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>CS-40</u>			5. NAME OF DRILLER <u>BURKS</u>			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL			7. THICKNESS OF OVER-BURDEN		8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE <u>21.0'</u>			10. SIZE AND TYPE OF BIT <u>1 3/8" ID SPLIT SPOON</u>			
11. DATUM FOR ELEVATION SHOWN (<u>MSL</u> or MSL)			12. MANUFACTURER'S DESIGNATION OF DRILL <u>FALLING 314 C.D. #104</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN <u>3</u>			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER	
16. DATE HOLE STARTED <u>18 JUNE 64</u> COMPLETED <u>18 JUNE 64</u>			17. ELEVATION TOP OF HOLE <u>40.0' FST.</u>			
18. TOTAL CORE RECOVERY FOR BORING (%)			19. SIGNATURE OF INSPECTOR <u>Allen H. Hewitt</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0'		SM - TAN SILTY FINE TO MEDIUM SAND		JAR 1	
	5'		SP - GRAY MEDIUM SAND		2	▼ 18 JUNE 64 W.T.
	10'		SM - SILTY FINE SAND WITH TRACE S&G		3	
	15'		GRAY S&G CLAY			
	20'		SILTY FINE SAND			
			Soils field classified in accordance with the Unified Soil Classification System.			BLOWS PER FOOT: Number required to drive 1 1/2" ID splitspoon w/140 lb. hammer falling 30".

SINCE



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WASHINGTON, BALTIMORE
GREENVILLE, ROANOKE, FAYETTEVILLEReport No. **BN 8161**

BORING LOG

Made for: **U. S. Army District Engineer, Corps of Engineers**Project: **Borrow Area in Vicinity of Tarboro, N. C.**Location: **Tarboro, N. C.**

Hole No. FR-1	Elevation—Top of Hole	Elevation—Ground Water no water	Station	Offset
Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-19-65	Completed 10-19-65	Inspector Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	1.0'		Topsoil.	5	1.5'	
				9	3.0'	
			Light brown sand.	14	4.5'	
				17	6.0'	
				21	7.5'	
				24	9.0'	
	10.5'			30	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140 lb. Hammer, 20 in. Fall, Required to Drive 2 in. O.D. 1 3/4 in. I.D. Sample One Foot.

Scale 1"=



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Report No. RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers										
Project: Borrow Area in Vicinity of Tarboro, N. C.										
Location: Tarboro, N. C.										
Hole No. FR-2		Elevation—Top of Hole		Elevation—Ground Water		Station		Offset		
				7.0' at time of boring						
Size and Type of Bit			Total Depth		Started		Completed		Inspector	
1 1/2" Auger			10.5'		10-19-65		10-19-65		Whitt & Johnson	
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)			** Sample Blows	Depth of Samples		REMARKS	
	0.0'						0.0'			
	1.0'		Dark Topsoil.			6	1.5'			
			Light brown sand.			9	3.0'			
	5.0'					17	4.5'			
	6.0'		Reddish brown fine & coarse sand.			17	6.0'			
			Light brown fine and coarse sand. Sample wet.			27	7.5'			
						30	9.0'			
	10.5'					34	10.5'			
			Boring terminated.							

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Report No. RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers							
Project: Borrow Area in Vicinity of Tarboro, N. C.							
Location: Tarboro, N. C.							
Hole No. FR-3		Elevation—Top of Hole		Elevation—Ground Water		Station	
				6.0' at time of boring			
Size and Type of Bit			Total Depth		Started		Completed
4 1/2" Auger			10.5'		10-19-65		10-19-65
							Inspector
							Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)			** Sample Blows	Depth of Samples
	0.0'						0.0'
	2.0'		Dark black fine sandy topsoil.			5	1.5'
						8	3.0'
	4.5'		Light brown fine sand.			11	4.5'
						17	6.0'
			Light brown fine and coarse sand. Very wet.			23	7.5'
						30	9.0'
	10.5'					37	10.5'
			Boring terminated.				

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

Scale 1"=

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GREENVILLE, ROANOKE, FAYETTEVILLEReport No. **RN 8161****BORING LOG**Made for: **U. S. Army District Engineer, Corps of Engineers**Project: **Borrow Area in Vicinity of Tarboro, N. C.**Location: **Tarboro, N. C.**

Hole No. FR-4	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		8.0' at time of boring		
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	10.5'	10-19-65	10-19-65	Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	3.5'		Light brown sand with black topsoil.	4	1.5'	
				6	3.0'	
			Light brown fine sand.	12	4.5'	
	7.5'			15	6.0'	
				21	7.5'	
	10.5'		Light brown coarse and fine sand. Sample wet.	21	9.0'	
				25	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

Scale 1"=

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Report No. **RN 8161****BORING LOG**Made for: **U. S. Army District Engineer, Corps of Engineers**Project: **Borrow Area in Vicinity of Tarboro, N. C.**Location: **Tarboro, N. C.**

Hole No. FR-5	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		7.5' at time of boring		
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	10.5'	10-19-65	10-19-65	Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	1.0'		Topsoil.			
			Light brown fine sand.	3	1.5'	
	3.5'			5	3.0'	
			Light brown fine and coarse sand.	8	4.5'	
	6.0'			11	6.0'	
			Fine and coarse sand, small rocks.	15	7.5'	
			Very wet.	20	9.0'	
	10.5'			23	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

Scale 1" = 4.0'

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Report No. **RN 8161**

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers						
Project: Borrow Area in Vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-6		Elevation—Top of Hole		Elevation—Ground Water		Station
				8.0' at time of boring		Offset
Size and Type of Bit		Total Depth		Started		Completed
4 1/2" Auger		10.5'		10-19-65		10-19-65
						Inspector Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	No. of Blows Revised	Depth of Samples
						REMARKS
	0.0'					0.0'
	1.0'		Dark black topsoil.	4		1.5'
			Fine light brown sand.	7		3.0'
	3.5'					
	5.0'		Reddish brown fine and coarse sand.	13		4.5'
			Light tan and brown sand.	12		6.0'
	7.5'			21		7.5'
			Light brown fine and coarse sand.	23		9.0'
	10.5'		Small gravel.			
				27		10.5'
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30 in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot



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BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers						
Project: Borrow Area in Vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-7		Elevation—Top of Hole		Elevation—Ground Water		Station
Size and Type of Bit		Total Depth		Started		Completed
4 1/2" Auger		10.5'		10-20-65		10-20-65
						Inspector Whitt & Johnson
Elevation	Depth	Casing Blows	CLASSIFICATION OF MATERIALS (Description)	Sample Blows	% Core Recovery	Depth of Sample
	0.0'					0.0'
	2.0'		Light brown fine sand.	8	1.5'	
				11	3.0'	
	4.5'		Reddish brown fine sand. Some medium grain sand.	19	4.5'	
	6.0'		Reddish grey sand and gravel.	40	6.0'	
				37	7.5'	
			Greyish sand and gravel.	34	9.0'	
	10.5'			27	10.5'	
			Boring terminated.			



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Report No. RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers						
Project: Borrow Area in Vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-8		Elevation—Top of Hole		Elevation—Ground Water		Station
Size and Type of Bit		Total Depth		Started	Completed	Inspector
4 1/2" Auger		10.5'		10-20-65	10-20-65	Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	10-20-65	Depth of Samples REMARKS
	0.0'				0.0'	
	1.0'		Topsoil.	9	1.5'	
			Light brown fine sand. Silty clayey sand.	11	3.0'	
	3.5'			14	4.5'	
			Light brown sand.	22	6.0'	
	6.5'			24	7.5'	
	8.0'		Light grey fine sand. Reddish brown coarse sand.	31	9.0'	
	9.5'		Light grey sand.	40	10.5'	
	10.5'		Reddish brown fine and coarse sand. Not.			
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.
**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1 3/8 in I.D. Sample One Foot. Scale 1"=

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Report No. **RN-8161**

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.						
Project: Borrow area in vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-9		Elevation—Top of Hole		Elevation—Ground Water 4.0' at time of boring		Station
Size and Type of Bit 4 1/2" Auger		Total Depth 9.0'		Started 10-20-65	Completed 10-20-65	Inspector Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'					
	1.0'		Top soil.	9	1.5'	
			Brown fine sand, multicolored fine and coarse sand.	8	3.0'	
	5.0'			17	4.5'	
			White, brown fine and coarse sand.	17	6.0'	
	8.0'			30	7.5'	
	9.0'		Dark grey clayey sand.	50	9.0'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

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Report No. RN-8161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.

Project: Borrow area in vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-10	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		3.0' at time of boring		
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	9.0'	10-21-65	10-21-65	Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'					
	1.0'		Top soil.	7	1.5'	
			Light brown sand. Wet. Some course fine sand and gravel.	11	3.0'	
				21	4.5'	
				25	6.0'	
	8.0'			28	7.5'	
	9.0'		Blueish-grey clayey sand.	11	9.0'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140 lb. Hammer, 30-in. Fall Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot.

Scale 1"=

50'



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Report No. **RN-8161**

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.						
Project: Borrow area in vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-11		Elevation—Top of Hole		Elevation—Ground Water 5.0' at time of boring		Station
Size and Type of Bit 4 1/2" Auger		Total Depth 10.5'		Started 10-21-65	Completed 10-21-65	Inspector Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'					
	1.0'		Top soil.	9	1.5'	
	2.0'		Reddish brown fine sand.	12	3.0'	
	3.5'		Brown with some clay.	19	4.5'	
			Light brown coarse sand.	23	6.0'	
				28	7.5'	
				26	9.0'	
	10.5'			35	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

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Report No. RN-8161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.						
Project: Borrow area in vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No.	FR-12	Elevation—Top of Hole	Elevation—Ground Water 7 1/2' at time of boring		Station	Offset
Size and Type of Bit	4 1/2" Auger	Total Depth	12.5'	Started	10-19-65	Completed 10-19-65
				Inspector Whitt & Johnson		
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
0.0'						
1.0'			Top soil.	5	1.5'	
				8	3.0'	
			Light brown fine sand.	12	4.5'	
6.5'				10	5.0'	
			Reddish brown and grey fine sand.	17	7.5'	
9.0'				25	9.0'	
			Light grey fine sand.	28	10.5'	
11.0'						
12.5'			Reddish brown fine and coarse sand. Wet.	9	12.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

Scale 1"=

5 0 1

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1881

Report No. RN-6161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineer, Wilmington, N. C.						
Project: Borrow area in vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-13		Elevation—Top of Hole		Elevation—Ground Water		Station
				7.5' at time of boring		Offset
Size and Type of Bit			Total Depth	Started	Completed	Inspector
4 1/2" Auger			9.0'	10-19-65	10-19-65	Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'					
	1.0'		Top soil.	18	1.5'	
	2.0'		Light brown fine sand.			
	2.5'		Reddish brown fine sand.	19	3.0'	
			Light brown fine sand.	15	4.5'	
	5.0'					
	6.5'		Reddish brown fine sand.	15	6.0'	
			Grey and light brown fine sand.	21	7.5'	
	9.0'		Wet.	22	9.0'	
			Boring terminated.			

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Report No. RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers

Project: Borrow Area in Vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-14	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		9.0' at time of boring		
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	10.5'	10-19-65	10-19-65	Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
0.0'					0.0'	
0.5'			Pine bark.			
2.0'			Light brown fine sand.	9	1.5'	
3.5'			Reddish brown fine sand.	10	3.0'	
				13	4.5'	
			Light brown fine sand.	15	6.0'	
				18	7.5'	
8.5'				25	9.0'	
10.5'			Dark green fine sand with shell present.	31	10.5'	
			Boring terminated.			

* of Blow

Drive Casing One Foot.

2 in. O.D. 1 3/8 in. I.D. Sample One Foot

Scale 1" =

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Report No. RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers

Project: Borrow Area in Vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-15	Elevation—Top of Hole	Elevation—Ground Water no Water	Station	Offset
Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-20-65	Completed 10-20-65	Inspector Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	1.5'		Light brown topsoil.	8	1.5'	
	3.0'		Yellowish brown fine sand.	11	3.0'	
			Reddish grey fine grain sand.	9	4.5'	
	6.0'			15	6.0'	
			Reddish brown coarse sand.	25	7.5'	
				30	9.0'	
	10.5'			37	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot

Scale 1"=

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Report No. **RN 8161****BORING LOG**Made for: **U. S. Army District Engineer, Corps of Engineers**Project: **Borrow Area in Vicinity of Tarboro, N. C.**Location: **Tarboro, N. C.**

Hole No. FR-16	Elevation—Top of Hole	Elevation—Ground Water no water	Station	Offset
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Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-20-65	Completed 10-20-65	Inspector Whitt & Johnson
---	-----------------------------	----------------------------	------------------------------	---

Elevation	Depth	Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'				0.0'	
	1.0'		Topsoil.	5	1.5'	
	3.5'		Reddish brown fine sand.	7	3.0'	
				9	4.5'	
			Light brown coarse fine sand.	17	6.0'	
				29	7.5'	
				31	9.0'	
	10.5'			34	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot.

Scale 1"=

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Report No. RN-8161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.

Project: Borrow area in vicinity of Tarboro, N.C.

Location: Tarboro, N. C.

Hole No. FR-17	Elevation—Top of Hole	Elevation—Ground Water no water (very dry)	Station	Offset
Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-25-65	Completed 10-25-65	Inspector Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
0.0'						
1.0'			Top soil.	10	1.5'	
			Light brown fine sand, some gravel.	8	3.0'	
5.0'				11	4.5'	
			Reddish dark brown fine and coarse sand.	34	6.0'	
8.0'				40	7.5'	
9.5'			Light tan fine sand.	45	9.0'	
10.5'			Reddish brown fine and coarse sand, gravel present.	50	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

Scale 1"= 5.0'

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Report No. RN-8161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.

Project: Borrow area in vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-18	Elevation—Top of Hole	Elevation—Ground Water no water	Station	Offset
Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-19-65	Completed 10-19-65	Inspector Whitt & Johnson

Elevation	Depth	Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
0.0'	0.5'		Top soil.			
			Light tan fine sand.	9	1.5'	
	3.5'			15	3.0'	
			Light brown and white fine sand.	18	4.5'	
	6.5'			22	6.0'	
			Light brown coarse and fine sand. Sample dry.	25	7.5'	
	10.5'			28	9.0'	
				15	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot

Scale 1" =

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Report No. RN-8161

BORING LOG

Made for: U. S. Army Engineer District, Corps of Engineers, Wilmington, N. C.

Project: Borrow area in vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-19	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		6.5' at time of boring		

Size and Type of Bit 4 1/2" Auger	Total Depth 10.5'	Started 10-21-65	Completed 10-21-65	Inspector Whitt & Johnson
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Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	% Core Recovery	REMARKS
	0.0'					
	1.5'		Grey top soil.	9	1.5'	
				13	3.0'	
	5.0'		Light brown multicolored fine sand.	15	4.5'	
				21	6.0'	
			Dark brown fine and coarse sand.	22	7.5'	
				30	9.0'	
	10.5'			36	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot.

Scale 1"=



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Report No. **RN 8161** **BORING LOG**

Made for: U. S. Army District Engineer, Corps of Engineers						
Project: Boxow Area in Vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-20		Elevation—Top of Hole		Elevation—Ground Water no water		Station
Size and Type of Bit 4 1/2" Auger		Total Depth 10.5'		Started 10-21-65		Completed 10-21-65
						Inspector Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	1.5'		Brown silty sand and clay.	14	1.5'	
	3.0'		Multicolored clayey sand.	18	3.0'	
			Brown silty sand.	21	4.5'	
	6.0'			19	6.0'	
	7.5'		Multicolored silty sand. Very fine.	21	7.5'	
			Brown clayey sand.	27	9.0'	
	10.5'			34	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.
**No. of Blows 140-lb. Hammer, 30 in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot. Scale 1"=

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Report No.

RN 8161

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers

Project: Borrow Area in Vicinity of Tarboro, N. C.

Location: Tarboro, N. C.

Hole No. FR-21	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
		11.0' at time of boring		
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	12.0'	10-21-65	10-21-65	Whitt & Johnson

Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
0.0'					0.0'	
1.5'			Topsoil.	9	1.5'	
			light tan fine sand.	12	3.0'	
4.5'				14	4.5'	
			light brown silty sand.	17	6.0'	
				20	7.5'	
9.0'				24	9.0'	
			Brown clayey sand.	33	10.5'	
12.0'				37	12.0'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 20-in. Fall, Required to Drive 2-in. O.D. 1 1/2-in. I.D. Sample One Foot.

Scale 1" = 5' ±



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Report No. **RN 8161** **BORING LOG**

Made for: U. S. Army District Engineer, Corps of Engineers						
Project: Borrow Area in Vicinity of Tarboro, N. C.						
Location: Tarboro, N. C.						
Hole No. FR-22		Elevation—Top of Hole		Elevation—Ground Water		Station
				6.0' at time of boring		Offset
Size and Type of Bit			Total Depth	Started	Completed	Inspector
4 1/2" Auger			10.5'	10-22-65	10-22-65	Whitt & Johnson
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Samples	REMARKS
	0.0'				0.0'	
	1.5'		Brownish grey topsoil.	6	1.5'	
	3.0'		Light brown fine sand.	7	3.0'	
			Light tan fine sand.	11	4.5'	
				12	6.0'	
	7.5'			10	7.5'	
			Light brown fine sand.	14	9.0'	
	10.5'			15	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.
**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D., 1.375 in I.D. Sample One Foot.

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GREENVILLE, ROANOKE, FAYETTEVILLEReport No. **RN 8161****BORING LOG**Made for: **U. S. Army District Engineer, Corps of Engineers**Project: **Borrow Area in Vicinity of Tarboro, N. C.**Location: **Tarboro, N. C.**

Hole No. FR-23	Elevation—Top of Hole	Elevation—Ground Water	Station	Offset
Size and Type of Bit	Total Depth	Started	Completed	Inspector
4 1/2" Auger	10.5'	4.5' at time of boring	10-22-65	Whitt & Johnson

Elevation	Depth	Casing Blows	CLASSIFICATION OF MATERIALS (Description)	Sample Blows	% Case Blows	Depth of Samples	REMARKS
	0.0'					0.0'	
	1.0'		Black topsoil.	11		1.5'	
			Multicolored fine sand with some clay. Some coarse sand.	13		3.0'	
				17		4.5'	
	6.5'			21		6.0'	
			Light grey coarse sand.	28		7.5'	
				31		9.0'	
	10.5'			34		10.5'	
			Boring terminated.				

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2 in. O.D. 1 3/4 in. I.D. Sample One Foot.

Scale 1" =



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Report No. **RN 8161**

BORING LOG

Made for: U. S. Army District Engineer, Corps of Engineers										
Project: Borrow Area in Vicinity of Tarboro, N. C.										
Location: Tarboro, N. C.										
Hole No. FR-24		Elevation—Top of Hole		Elevation—Ground Water		Station		Offset		
				6.0' at time of boring						
Size and Type of Bit			Total Depth		Started		Completed		Inspector	
4 1/2" Auger			10.5'		10-22-65		10-22-65		Whitt & Johnson	
Elevation	Depth	* Casing Blows	CLASSIFICATION OF MATERIALS (Description)			** Sample Blows	Sample Blows	Depth of Samples		REMARKS
	0.0'							0.0'		
	1.5'		Black topsoil.			11		1.5'		
	3.0'		Multicolored fine and coarse sand.			13		3.0'		
	4.5'		Light grey coarse sand.			15		4.5'		
						18		6.0'		
			Dark grey coarse sand.			21		7.5'		
						24		9.0'		
	10.5'					23		10.5'		
			Boring terminated.							

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.

**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1 3/8-in. I.D. Sample One Foot.

Scale 1" = 10'



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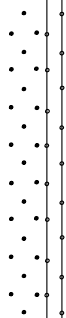
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Report No. **RN 8161** **BORING LOG**

Made for: **U. S. Army District Engineer, Corps of Engineers**
Project: **Borrow Area in Vicinity of Tarboro, N. C.**
Location: **Tarboro, N. C.**
Hole No. **FR-25** Elevation—Top of Hole Station Offset
Elevation—Ground Water **no water**
Size and Type of Bit **4 1/2" Auger** Total Depth **10.5'** Started **10-22-65** Completed **10-22-65** Inspector **Whitt & Johnson**

Elevation	Depth	Casing Blows	CLASSIFICATION OF MATERIALS (Description)	** Sample Blows	Depth of Penetration Depth of Samples	REMARKS
	0.0'				0.0'	
	0.5'		TOPSOIL.			
			Yellowish brown fine sand.	8	1.5'	
				10	3.0'	
	5.0'			12	4.5'	
			Brown fine and coarse sand.	15	6.0'	
				17	7.5'	
	9.5'			21	9.0'	
	10.5'		Reddish brown fine and coarse silty sand. Clay present.	25	10.5'	
			Boring terminated.			

*No. of Blows 250-lb. Hammer, 30-in. Fall, Required to Drive Casing One Foot.
**No. of Blows 140-lb. Hammer, 30-in. Fall, Required to Drive 2-in. O.D. 1.375 in I.D. Sample One Foot.
Scale 1"= 5.0'

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 3" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2443464 N 776249 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>WBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL HAND AUGER			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-A-1				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES		N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE : STARTED : 7/21/06 : COMPLETED : 7/21/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 5.0'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		CL Brown and tan, silt, trace fine to coarse sand		1	NOTE: WATER LEVEL DURING DRILLING WAS 2.0'. NOTE: BACKFILLED HOLE AFTER COMPLETION OF DRILLING.	
	1.0						
	2.0		SP/SM Tan and light gray, fine to medium sand, trace of silt		2		
	3.0						
	4.0		SP Tan and light gray, fine to coarse poorly graded sand		3		
	5.0		BOTTOM OF HOLE AT 5.0'			NOTE: HOLE TERMINATED AT 5.0'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 3" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2443654 N 776428 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL HAND AUGER			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-A-2				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 6		DISTURBED : UNDISTURBED	
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED : 7/21/06 : COMPLETED : 7/21/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 7.5'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc. if significant) g	
	0		SC Brown, silt, fine to coarse sand, plant material		1	NOTE: TOPSOIL FILL MAT'L NOTE: WATER LEVEL DURING DRILLING WAS 5.0'. NOTE: BACKFILLED HOLE AFTER COMPLETION OF DRILLING.	
	1.0		CL Brown and gray, sandy clays, trace fine to coarse sand		2		
	2.0						
	3.0		2.5' to 4.0' some fine to medium silty sand		3		
	4.0		SC Light gray, slightly clayey sand		4	NOTE: HOLE TERMINATED AT 7.5'	
	5.0		SP/SM Light brown, slightly silty fine to medium sand		5		
	6.0						
	7.0	Light gray, fine sand		6			
	7.5	BOTTOM OF HOLE AT 7.5'					
		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM					

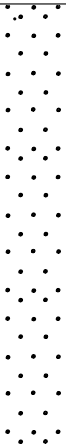
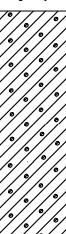
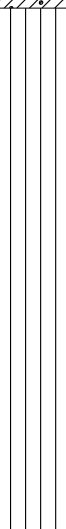
DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 3" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2444081N 777217 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL HAND AUGER			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-A-3				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED : 4 UNDISTURBED :	
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER		16. DATE HOLE : STARTED : 7/21/06 : COMPLETED : 7/21/06	
7. THICKNESS OF OVERBURDEN N/A				17. ELEVATION TOP OF HOLE			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING N/A %			
9. TOTAL DEPTH OF HOLE 5.0'				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ML Dark gray, sandy silt			NOTE: WATER LEVEL DURING DRILLING WAS 4.0'.	
	1.0				1		
	2.0		CL Orange and gray, slightly sandy clays		2		
	3.0		SP-SC Light gray, fine to medium sand, slightly clayey		3		
	4.0		SP Light gray, fine to medium poorly graded sand, trace of clay		4	NOTE: BACKFILLED HOLE AFTER COMPLETION OF DRILLING.	
	5.0		BOTTOM OF HOLE AT 5.0'			NOTE: HOLE TERMINATED AT 5.0'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 3" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2444561 N 778158 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>N/TBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL HAND AUGER			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-A-4				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 4 : UNDISTURBED			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE : STARTED : 7/21/06 : COMPLETED : 7/21/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 6.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			

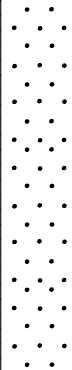
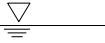
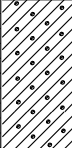
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		ML Tan and dark brown, sandy silt		1	NOTE: WATER LEVEL DURING DRILLING WAS 4.5'.
	0.6'		CL Tan, sandy clays, sand seam at 2.5'		2	
	2.0				2.0'	
	3.5'				3	
	4.0'		SC Light gray, fine clayey sand		4	
	6.0'		SP Light gray, fine to medium sand, clean		4	
	6.5'		BOTTOM OF HOLE AT 6.5'		6.5'	NOTE: HOLE TERMINATED AT 6.5'
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2435605.7 N 776969.0 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>BM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-02				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 9		DISTURBED : 0 UNDISTURBED : 0	
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED : 6/29/06 : COMPLETED : 6/29/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 30.0'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			

ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
42.8	0		SP Brown, fine to medium poorly graded sand		1	DRIVE 1 0.0' TO 5.0'
	1.0'					
	3.0'					
	4.0'					
	5.0'					
	6.0		CL Brownish orange, lean clay		3	DRIVE 2 5.0' TO 10.0'
	8.0					
	10.0		SC Brownish orange, clayey sand		4	
	11.0					
	12.0		SP Brown, coarse poorly graded sand		5	DRIVE 3 10.0' TO 15.0'
	14.0					
						W.L. 12.00
			CONTINUED ON SHEET 2			NOTE: HOLE TERMINATED AT 30.0'

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-02		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION o	DEPTH 14.0	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SP Brown, coarse poorly graded sand			DRIVE 3 CONTINUE
	16.0			16.0'	6	DRIVE 4 15.0' TO 20.0'
				17.0'		
	18.0			20.0'		
	20.0		SC Greenish gray, medium clayey sand		7	DRIVE 5 20.0' TO 25.0'
	22.0			21.0'		
				23.0'		
	24.0		ML Greenish tan sandy silts		8	DRIVE 6 25.0' TO 30.0'
				24.0'		
	26.0			27.0'		
	28.0			28.0'		
12.8	30.0		BOTTOM OF HOLE AT 30.0'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2435581.2 N 777626.9 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>(B.M. or MSL)</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-03				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 8 : 0 : 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED : 6/29/06 : COMPLETED : 6/29/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 30.0'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH							
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		SP Brown, coarse poorly graded sand		1	DRIVE 1 0.0' TO 5.0'	
	1.0'						
	2.0						
	4.0						
			SC Brown, clayey sand		4.5'	DRIVE 2 5.0' TO 10.0'	
	6.0				2		
					5.5'		
					7.0'		
			SP Brown, coarse poorly graded sand		3	DRIVE 3 10.0' TO 15.0'	
	8.0				8.0'		
	10.0				11.0'		
	12.0				12.0'		
			SM Black fine silty sand sand		4	NOTE: HOLE TERMINATED AT 30.0'	
	14.0						
			CONTINUED ON SHEET 2				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

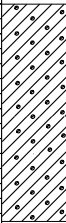
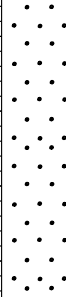
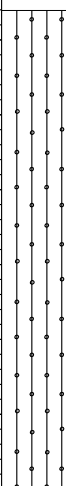
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-03		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. 14.0'	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			CL Black, lean clay		5	DRIVE 3 CONTINUE
	15.0'				DRIVE 4 15.0' TO 20.0'	
	16.0		SP Tan, coarse poorly graded sand		18.0'	 W.L. 17.00
	18.0				6	
	19.0				7	DRIVE 5 20.0' TO 25.0'
	20.0				23.0'	
	22.0		SC Greenish gray, fine clayey sand		24.0'	DRIVE 6 25.0' TO 30.0'
	24.0				24.0'	
	26.0		NO RECOVERY			NOTE: NO RECOVERY, BECAUSE MATERIAL WAS TOO STIFF TO PUSH.
	28.0					
	29.8'				8	
	30.0		ML Olive gray, sandy silts		30.0'	
			BOTTOM OF HOLE AT 30.0'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2435489.9 N 778302.7 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>WBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-04				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 8 : DISTURBED : 0 : UNDISTURBED			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE : STARTED : 6/29/06 : COMPLETED : 6/29/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 30.0'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0	•••••	SP Brown, fine to medium poorly graded sand		1	DRIVE 1 0.0' TO 5.0'	
	1.0'	•••••					
	2.0	•••••					
	3.0'	•••••					
	4.0	•••••			2		
	5.0'	•••••					
	6.0	•••••	Yellowish brown		3	DRIVE 2 5.0' TO 10.0'	
	7.0'	•••••					
	8.0	•••••					
	9.0'	•••••					
	10.0	•••••			4	DRIVE 3 10.0' TO 15.0'	
	11.0'	•••••					
	12.0	•••••					
	13.0'	•••••					
	14.0	•••••				 W.L. 12.50	
			CONTINUED ON SHEET 2			NOTE: HOLE TERMINATED AT 30.0'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-04		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SP Yellowish brown, coarse poorly graded sand			DRIVE 3 CONTINUE
	16.0					DRIVE 4 15.0' TO 20.0'
			White			
	18.0		CL Greenish gray, sandy clays		18.0'	
					5	
	20.0				19.0'	
						DRIVE 5 20.0' TO 25.0'
	22.0					
	24.0		CH Purple and gray fat clay		24.0'	
					6	
	26.0		SM Gray, fine silty sand	25.0'	7	DRIVE 6 25.0' TO 30.0'
	28.0				26.0'	
			CH Purple and gray fat clay		28.5'	
	30.0				8	
					29.5'	
			BOTTOM OF HOLE AT 30.0'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2435324.2 N 779030.8 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-05				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 7 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.8' ASPHALT				16. DATE HOLE : STARTED 6/28/06 : COMPLETED 6/28/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 30.8'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT				
			SP Tan, Coarse poorly graded sand		0.8'		
	2.0				1		DRIVE 1 0.8' TO 5.8'
					1.8'		
	4.0		Olive green, traces of clay		4.0'		
					2		
	6.0				5.0'		DRIVE 2 5.8' TO 10.8'
					7.0'		
	8.0		Yellowish brown		3		
					8.0'		
	10.0				11.0'		DRIVE 3 10.8' TO 15.8'
					4		
	12.0				12.0'		
			Gray				
	14.0						
			CONTINUED ON SHEET 2				
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				NOTE: HOLE TERMINATED AT 30.0'

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PFR-06-05	
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			SP Gray, coarse poorly graded sand			DRIVE 3 CONTINUE
	16.0					▽ W.L. 15.80 DRIVE 4 15.8' TO 20.8'
	18.0		Whitish gray		18.0'	
					5	
	20.0				19.0'	
					20.8'	
			ML Gray sandy silts		6	DRIVE 5 20.8' TO 25.8'
	22.0				21.8'	
	24.0					
	26.0		NO RECOVERY			DRIVE 6 25.8' TO 30.8'
	28.0					NOTE: NO RECOVERY, BECAUSE MATERIAL WAS TOO STIFF TO PUSH.
	30.0				30.3'	
	30.8		ML Reddish brown, sandy silts		7	
			BOTTOM OF HOLE AT 30.8'		30.8'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2434684.4 N 779896.7 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>WTBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-06				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 8 : 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.6' ASPHALT				16. DATE HOLE : STARTED : 6/28/06 : COMPLETED : 6/28/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 30.6'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.6'		
	2.0		SC Brown, fine clayey sand		1	DRIVE 1 0.6' TO 5.6'	
	4.0		SP White and tan, coarse poorly graded sand		2		
	6.0				3	DRIVE 2 5.6' TO 10.6'	
	8.0		SM Grayish tan, fine silty sand		4	DRIVE 3 10.6' TO 15.6'	
	10.0				5		
	12.0				6		
	14.0				7		
			CONTINUED ON SHEET 2			NOTE: HOLE TERMINATED AT 30.6'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

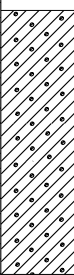
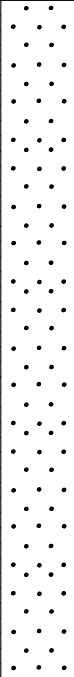
DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-06		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		•••••	SM Grayish tan, fine silty sand			DRIVE 3 CONTINUE
	16.0	/ / / / /	SC Brownish orange, fine clayey sand		15.6'	
					5	DRIVE 4 15.6' TO 20.6'
	18.0				16.6'	
		•••••	SP Brownish orange, coarse poorly graded sand		19.0'	
	20.0				6	
					20.0'	DRIVE 5 20.6' TO 25.6'
	22.0					▽ W.L. 22.00
	24.0		Whitish tan		24.0'	
					7	
	26.0				25.0'	DRIVE 6 25.6' TO 30.6'
					27.5'	
	28.0	•••••	SM Gray, fine silty sand		8	
					28.5'	
	30.0					
	30.6		BOTTOM OF HOLE AT 30.6'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 6" X 7 3/4" BRL & 1 3/8" SPT			
2. LOCATION (Coordinates or Station) NC Coord. E 2441259.7 N 784443.7 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL FALING 1500			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-07				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 2 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.52' ASPHALT				16. DATE HOLE : STARTED 6/22/06 : COMPLETED 6/22/06			
8. DEPTH DRILLED INTO ROCK 1.08' CONCRETE				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 4.08'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR TRACEY TAPLEY GEOLOGIST			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT 0.52'			BLOWS PER FOOT	
			CONCRETE 0.56'		1.08'		
	2.0		SM Brown, fine to medium silty sand 2.58'		1	DRIVE 1 1.08' TO 2.58' 25	
			SC Orangish brown, fine to medium clayey sand 4.08'		2.58' 2	DRIVE 2 2.58' TO 4.08' 16	
	4.08		BOTTOM OF HOLE AT 4.08'		4.08'	NOTE: HOLE TERMINATED AT 4.08'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: CORING ROADWAY ALONG HWY 258	
						NOTE: 76 RPM, 100 MAX PRESSURE, AT 0.6' SLOWED IN CUTTING	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 6" X 7 3/4" BRL & 1 3/8" SPT			
2. LOCATION (Coordinates or Station) NC Coord. E 2443956.7 N 785731.1 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>TBM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL FALING 1500			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-08				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 2 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.80' ASPHALT				16. DATE HOLE : STARTED 6/22/06 : COMPLETED 6/22/06			
8. DEPTH DRILLED INTO ROCK 0.55' CONCRETE				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 4.35'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR TRACEY TAPLEY GEOLOGIST			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT			BLOWS PER FOOT	
			CONCRETE	0.80'			
	2.0		SM Orangish Brown, fine silty sand	0.55'	1.35'		
					1	DRIVE 1 1.35' TO 2.85'	33
					2.85'	DRIVE 2 2.85' TO 4.35'	25
	4.0				2		
	4.08		BOTTOM OF HOLE AT 4.35'		4.35'	NOTE: HOLE TERMINATED AT 4.35'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: CORING ROADWAY ALONG HWY 258	
						NOTE: 150 RPM, 150 PSI INCREASE RPM TO 170 AND 150 PSI.	

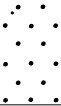
DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 6" X 7 3/4" BRL & 1 3/8" SPT			
2. LOCATION (Coordinates or Station) NC Coord. E 2445861.2 N 787651.3 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>NBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-09				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : 2 : UNDISTURBED : 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.55' ASPHALT				16. DATE HOLE : STARTED : 6/22/06 : COMPLETED : 6/22/06			
8. DEPTH DRILLED INTO ROCK 0.53' CONCRETE				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 4.08'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR TRACEY TAPLEY GEOLOGIST			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT 0.55'			BLOWS PER FOOT	
			CONCRETE 0.53'		1.08'		
	2.0		SM Brown, fine silty sand		1	DRIVE 1 1.08' TO 2.58' 47	
			2.58' Yellowish brown		2.58'	DRIVE 2 2.58' TO 4.08' 8	
	4.08		BOTTOM OF HOLE AT 4.08'		4.08'	NOTE: HOLE TERMINATED AT 4.08'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: CORING ROADWAY ALONG HWY 258	
						NOTE: 150 RPM, 150 PSI INCREASE RPM 170 AND 125 PSI	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 6" X 7 3/4" BRL & 1 3/8" SPT			
2. LOCATION (Coordinates or Station) NC Coord. E 2446689.4 N 786344.1 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-10				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 2 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.25' ASPHALT				16. DATE HOLE : STARTED 6/22/06 : COMPLETED 6/22/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 3.25'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR TRACEY TAPLEY GEOLOGIST			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT 0.25'		0.25'	BLOWS PER FOOT	
	1.75'		SC Orangish brown, fine clayey sand		1	DRIVE 1 1.08' TO 2.58' 25	
	2.0		Brown mottling		1.75'		
	2.75'		SM Orangish brown/light gray fine silty sand		2	DRIVE 2 2.58' TO 4.08' 34	
	4.08		BOTTOM OF HOLE AT 4.08'		3.25'	NOTE: HOLE TERMINATED AT 4.08'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: CORING ROADWAY ALONG HWY 258	
						NOTE: 60 RPM, 150 PSI INCREASE TO 160 RPM.	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2446244.4 N 787154.1 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>MBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-15				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 5 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.5' ASPHALT				16. DATE HOLE : STARTED 6/29/06 : COMPLETED 6/29/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'		
			SC Brown, fine clayey sand		1	DRIVE 1 0.5' TO 5.5'	
	2.0			1.5'			
	4.0			4.0'			
			SP Tan, coarse poorly graded sand		2		
	6.0			5.0'			
	8.0			7.0'			
				3	DRIVE 2 5.5' TO 10.5'		
				8.0'	W.L. 7.50		
	10.0			10.0'			
	12.0			11.0'	DRIVE 3 10.5' TO 15.5'		
				13.0'			
	14.0		CL Dark gray, lean clays		5		
		CONTINUED ON SHEET 2			14.0'	NOTE: HOLE TERMINATED AT 15.5'	
		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM					

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-15		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVER- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15.5		ML Dark gray lean clays			DRIVE 3 CONTINUE TO 15.5'
			BOTTOM OF HOLE AT 15.5'			
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 1/2" PUSH TUBE			
2. LOCATION (Coordinates or Station) NC Coord. E 2447024.5 N 785736.5 (NAD 83)				11. DATUM FOR ELEVATION SHOWN MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL GEO PROBE			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-16				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 6 : DISTURBED : 6 : UNDISTURBED : 0			
5. NAME OF DRILLER JOHN HOWLEY				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN 0.4' ASPHALT				16. DATE HOLE : STARTED : 6/29/06 : COMPLETED : 6/29/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.4'		
			SC Brownish orange, fine clayey sand		1	DRIVE 1 0.4' TO 5.4'	
	2.0		SM Gray, fine silty sand		1.4' 2.0'		
					2		
	4.0				3.0'		
			CH Brown, fat clay		4.4'		
					3		
	6.0				5.4'	DRIVE 2 5.4' TO 10.4'	
			SC Tan, fine clayey sand		7.5'		
	8.0		SM Gray, fine silty sand		4	W.L. 7.50	
					8.5'		
			SP Whitish gray, coarse poorly graded sand		9.4'		
	10.0				5		
					10.4'	DRIVE 3 10.4' TO 15.4'	
	12.0				13.0'		
					6		
	14.0				14.0'		
CONTINUED ON SHEET 2							
SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM							
				NOTE: HOLE TERMINATED AT 15.4'			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-16		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 14.0 b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15.5		SP Whitish gray, coarse poorly graded sand			DRIVE 3 CONTINUE TO 15.4'
			BOTTOM OF HOLE AT 15.4' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2435605.2 N 776368.0 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-1				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 17 UNDISTURBED 0			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE STARTED 7/19/06 COMPLETED 7/19/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 25.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
43.4	0		SM Brown, fine silty sand trace of gravel		1	BLOWS PER FOOT: 14	
			Yellowish brown		2	38	
	3.0		Fine to medium grain sizes		3	NOTE: WATER LEVEL DURING DRILLING WAS 12.7'. 32	
	6.0		SP Brown fine poorly graded sand, trace of silt		4	NOTE: NO 24 HRS. READING BECAUSE MUD IN HOLE. 15	
			Yellowish tan		5 A	18	
					5 B	18	
	9.0				6	16	
					7	18	
	12.0		SP/SM Tan, fine poorly graded silty sand		8	26	
					9 A	19	
					9 B	19	
	15.0				10	11	
			SP Tan coarse poorly graded sand, trace of tiny gravel		11	9	
	18.0				12	18	
		Some pea gravel		13	17		
	21.0	SM Gray, fine silty sand trace of pea gravel		14	NOTE: HOLE TERMINATED AT 25.5' 13		
		CONTINUED ON SHEET 2				BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	
		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM					

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2435324.2 N 779030.8 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>NBM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-SS-5				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 16 : UNDISTURBED 0			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED 7/20/06 : COMPLETED 7/20/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 30.0'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
			SM Gray, fine silty sand trace of pea gravel		1	55	
	3.0		SP/SM Tan, fine to medium poorly graded silty sand trace of gravel and clay		2	NOTE: WATER LEVEL DURING DRILLING WAS 16.0'.	
			ML Rusted brown, sandy silt		3 A	82	
	6.0		SM Brown, fine silty sand Fine/medium grain sizes Dark gray		3 B	63	
			SP/SM Yellowish brown, fine poorly graded silty sand		4 A	53	
	9.0				4 B	74	
					5 A	106	
	12.0				5 B	40	
			SM Dark gray, fine silty sand Fine to medium grain sizes		6	52	
	15.0				7	70	
					8	43	
	18.0				9	20	
			SP Gray, coarse poorly graded sand		10	NOTE: HOLE TERMINATED AT 25.5'	
	20.0				11	24 HRS. ▽	
					12	W.L. 17.00	
					13	21	
CONTINUED ON SHEET 2							
SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES			

DRILLING LOG (Cont Sheet)		ELEVATION TOP OF HOLE		Hole No. PFR-06-SS-5		
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH 20.0	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			CL Gray, lean clay, traces of sand		14	NOTE: AT 20.0' LOOSING DRILLING FLUID. HIT POROUS SAND LAYER. 52
	23.0		CLEAN OUT			NOTE: SWITCHED DRIVE SAMPLING DUE TO OVERRUN ON "DOT" FLAGMAN TIME AND INCOMING TUNDR STORMS.
			ML Grayish tan, sandy silt		15	100
	26.0		CLEAN OUT			NOTE: HOLE CAVE IN AT 20'. SWITCH TOOLS TO FISHTAIL AND MUD ROTARY.
	29.0		ML Purple and tan, sandy silt		16	NOTE: ENCOUNTERED FLOWING SAND AT 20.0'. 56
	30.0		BOTTOM OF HOLE AT 25.5'			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 2 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2434684.4 N 779896.7 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>NBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-SS-6				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : UNDISTURBED : 20 : 0			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED : COMPLETED : 7/20/06 : 7/20/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 31.0'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT			BLOWS PER FOOT:	
			SM Brown, fine silty sand trace of clay		1.0'		
			Trace of pea gravel		1	57	
	3.0				2	59	
					3	50/0.5	
	6.0		No pea gravel		4	NOTE: WATER LEVEL DURING DRILLING WAS 25.0'. 57	
			Dark gray		5 A	78	
					5 B		
	9.0				6	93	
					7	70/0.5	
	12.0		Yellowish brown		8	63/0.3	
			Dark gray		9	50+/0.5	
			tightly packed		10 A		
	15.0		Brown		10 B	60	
			Yellowish brown		11	NOTE: HOLE TERMINATED AT 31.0' 71	
	18.0		SC Light brown, fine clayey sand		12	29	
			SP/SM Light brown fine poorly graded silty sand		13	27	
					14	24 HRS. ▽ W.L. 20.90 13	
	21.0						
	22.0						
			CONTINUED ON SHEET 2			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE			Hole No. PFR-06-SS-6	
PROJECT PRINCEVILLE FLOOD REDUCTION			INSTALLATION WILMINGTON DISTRICT			SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	22.0		SP/SM Tan, fine poorly graded silty sand		15	8	
					16	13	
	25.0		SP Tan, fine to coarse poorly graded sand		17	7	
			Brown		18	57	
	28.0		SM Gray, fine silty sand trace of clay		19	71	
					20	85/0.3	
	31.0		BOTTOM OF HOLE AT 31.0'			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPoon WITH 140 LB. HAMMER FALLING 30 INCHES	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2442108.4 N 784844.7 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>BM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-11				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 10 UNDISTURBED			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE STARTED 7/18/06 COMPLETED 7/18/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
			SM Brown, fine silty sand		1	22	
			Trace of clay		2	NOTE: WATER LEVEL DURING DRILLING WAS 10.5'.	
	3.0				3	9	
			CL Brown, lean clay with some sand		4	4	
	6.0		SP-SM Gray and tan, fine poorly graded silty sand		5	13	
			SC Brown, fine to medium clayey sand		6	26	
	9.0				7	24 HRS. W.L. 9.00	
			SP Brown, fine to medium poorly graded sand		8	16	
	12.0				9	4	
			Trace of pea gravel		10	10	
	15.0						
	15.5		BOTTOM OF HOLE AT 15.5'			NOTE: HOLE TERMINATED AT 15.5'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2443112.1 N 785321.2 (NAD 83)				11. DATUM FOR ELEVATION SHOW <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-SS-12				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED 10 ; UNDISTURBED			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE : STARTED 7/18/06 ; COMPLETED 7/18/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.6'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.6'	BLOWS PER FOOT:	
			SM Brown, fine silty sand		1	61	
	3.0		Light brown		2	NOTE: WATER LEVEL DURING DRILLING WAS 8.1'.	
			Brown and orange, loose		3 A	22	
					3 B	15	
	6.0		SP-SM Brown, fine poorly graded silty sand		4	18	
			SM Brown fine silty sand		5 A	24 HRS.	
			SP Beige coarse poorly graded sand		5 B	W.L. 8.10	
	9.0		SP/SM Brown and tan, fine poorly graded silty sand		6	16	
			SP Light gray coarse poorly graded sand		7	11	
	12.0		Trace of chert gravel		8	13	
			No gravel		9	12	
	15.0				10		
	15.6		BOTTOM OF HOLE AT 15.6'			NOTE: HOLE TERMINATED AT 15.6'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2444681.0 N 786339.5 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-SS-13				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 10			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN : N/A				16. DATE HOLE : STARTED : 7/18/06 : COMPLETED : 7/18/06			
8. DEPTH DRILLED INTO ROCK : N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE : 15.5'				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
		SM Rusted brown fine silty sand			1	30	
	3.0	SC Brown, fine clayey sand			2	NOTE: WATER LEVEL DURING DRILLING WAS 11.8'.	
					3	14	
	6.0	SM Gray, fine silty sand			4	12	
		SP/SM Gray, fine poorly graded silty sand Yellowish brown			5 A	16	
					5 B		
	9.0				6	27	
					7	27	
	12.0		Brownish tan		8	27	
		SP Tan, coarse poorly graded sand, trace of pea gravel			9	13	
	15.0	CH Gray, fat clay with sand			10 A		
	15.5				10 B	8	
		BOTTOM OF HOLE AT 15.5'				NOTE: HOLE TERMINATED AT 15.5'	
		SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM				BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

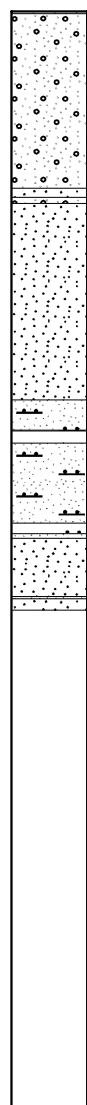
DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2445655.3 N 787417.8 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>(BM or MSL)</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) : PFR-06-SS-14				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : 10		DISTURBED : UNDISTURBED :	
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES : N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER		16. DATE HOLE : STARTED : 7/18/06 : COMPLETED : 7/18/06	
7. THICKNESS OF OVERBURDEN : N/A				17. ELEVATION TOP OF HOLE			
8. DEPTH DRILLED INTO ROCK : N/A				18. TOTAL CORE RECOVERY FOR BORING : N/A %			
9. TOTAL DEPTH OF HOLE : 15.6'				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.6'	BLOWS PER FOOT:	
			SM Dark gray, fine silty sand		1	18	
	3.0		Gray		2	NOTE: WATER LEVEL DURING DRILLING WAS 8.1'.	
					3	16	
	6.0		SPSM Beige, fine poorly graded silty sand		4 A	13	
			SP Yellowish tan, fine to medium poorly graded sand		4 B	24 HRS. ▽ W.L. 7.50	
	9.0		Trace of silt		5	32	
					6	16	
	12.0		With some tiny gravel		7	10	
			White and brown		8	17	
					9 A	9	
	15.0		CH Dark gray, fat clay trace of clayey sand (SC)		9 B	4	
	15.6				10		
			BOTTOM OF HOLE AT 15.6'			NOTE: HOLE TERMINATED AT 15.6'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2443540.00 N 781266.2 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-17				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 10 UNDISTURBED			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE STARTED 7/19/06 COMPLETED 7/19/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
			SM Brown, fine silty sand Tan and gray,		1	22	
	3.0		SC Brown, fine clayey sand CL Brown lean clay		2 A	NOTE: WATER LEVEL DURING DRILLING WAS 6.5'.	
					2 B	9	
			SM Brown, fine silty sand fine to medium grain sizes		3 A	4	
	6.0				3 B	24 HRS.	
			SP Tan, coarse poorly graded sand		4	W.L. 5.60	
					5	13	
	9.0		With some clay		6	26	
			No clay		7	16	
	12.0				8	4	
					9	10	
	15.0				10		
	15.5		BOTTOM OF HOLE AT 15.5'			NOTE: HOLE TERMINATED AT 15.5'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2445157.8 N 780516.4 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-18				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 10			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE STARTED 7/19/06 COMPLETED 7/19/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
			SM Brown, fine silty sand trace of clay		1	36	
			Gray		2	10	
	3.0				3 A	24 HRS.	
			ML-CL Gray, sandy lean clay		3 B	W.L. 3.90	
	6.0		SP/SM White, fine poorly graded silty sand		4	NOTE: WATER LEVEL	
			SP Light gray, medium to coarse poorly graded sand		5	DURING DRILLING WAS 5.2'.	
	9.0				6	18	
					7	17	
	12.0				8	21	
			Coarse grain sizes		9	16	
	15.0				10	11	
	15.5					12	
			BOTTOM OF HOLE AT 15.5'			29	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: HOLE TERMINATED AT 15.5'	
						BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2447467.0 N 779983.0 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>NBM</i> or <i>MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-19				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 10 UNDISTURBED			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE STARTED 7/19/06 COMPLETED 7/19/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.6'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.6'	BLOWS PER FOOT:	
			SM Gray, fine silty sand		1	25	
	3.0		CH Brown, fat clay		2	24 HRS. ▽ W.L. 3.00	
					3	15	
	6.0		CL Gray, lean clay		4 A	26	
			SP White, fine poorly graded sand Coarse grain sizes		4 B	NOTE: WATER LEVEL DURING DRILLING WAS 5.4'.	
					5	18	
	9.0				6	13	
					7	15	
	12.0				8	9	
					9		
	15.0				10	14	
	15.6						
			BOTTOM OF HOLE AT 15.6'			NOTE: HOLE TERMINATED AT 15.6'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	

DRILLING LOG		DIVISION SOUTH ATLANTIC		INSTALLATION WILMINGTON DISTRICT		SHEET 1 OF 1 SHEETS	
1. PROJECT PRINCEVILLE FLOOD REDUCTION				10. SIZE AND TYPE OF BIT 1 3/8" ID SPT. & 4" AUGER			
2. LOCATION (Coordinates or Station) NC Coord. E 2449862.2 N 780142.3 (NAD 83)				11. DATUM FOR ELEVATION SHOWN <i>BM or MSL</i> MSL			
3. DRILLING AGENCY SAVANNAH DISTRICT				12. MANUFACTURER'S DESIGNATION OF DRILL CME 550			
4. HOLE NO. (As shown on drawing title and file number) PFR-06-SS-20				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN : DISTURBED : UNDISTURBED : 10 : : 10			
5. NAME OF DRILLER JOHN HASKEW				14. TOTAL NUMBER CORE BOXES N/A			
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER			
7. THICKNESS OF OVERBURDEN N/A				16. DATE HOLE : STARTED : COMPLETED : 7/18/06 : 7/18/06			
8. DEPTH DRILLED INTO ROCK N/A				17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE 15.5'				18. TOTAL CORE RECOVERY FOR BORING N/A %			
				19. SIGNATURE OF INSPECTOR KELLEY KALTENBACH			
ELEVATION MSL	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	0		ASPHALT		0.5'	BLOWS PER FOOT:	
			SM Brown, fine silty sand trace of Asphalt		1	22	
	3.0		ML-CL Gray and brown, sandy lean clay		2	NOTE: WATER LEVEL DURING DRILLING WAS 10.5'.	
			Whitish gray		3 A	9	
			SM Light gray, fine silty sand		3 B	4	
	6.0		SP/SM Grayish tan, fine poorly graded silty sand		4	13	
					5	26	
	9.0		SP Light gray, coarse poorly graded sand, trace of pea gravel		6 A	24 HRS.	
					6 B	26	
					7	W.L. 9.00	
					8 A	16	
	12.0		CH Brown, fat clay		8 B	4	
			CL Brown, lean clay		9	10	
	15.0				10		
	15.5		BOTTOM OF HOLE AT 15.5'			NOTE: HOLE TERMINATED AT 15.5'	
			SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			BLOWS/FOOT: NUMBER REQUIRED TO DRIVE 1 3/8" ID SPLITSPOON WITH 140 LB. HAMMER FALLING 30 INCHES	



Gravelly sand to sand (7)

Clean sands to silty sands (6)

Silty sand to sandy silt (5)

Sensitive, fine grained (1)

Silty sand to sandy silt (5)

Clean sands to silty sands (6)

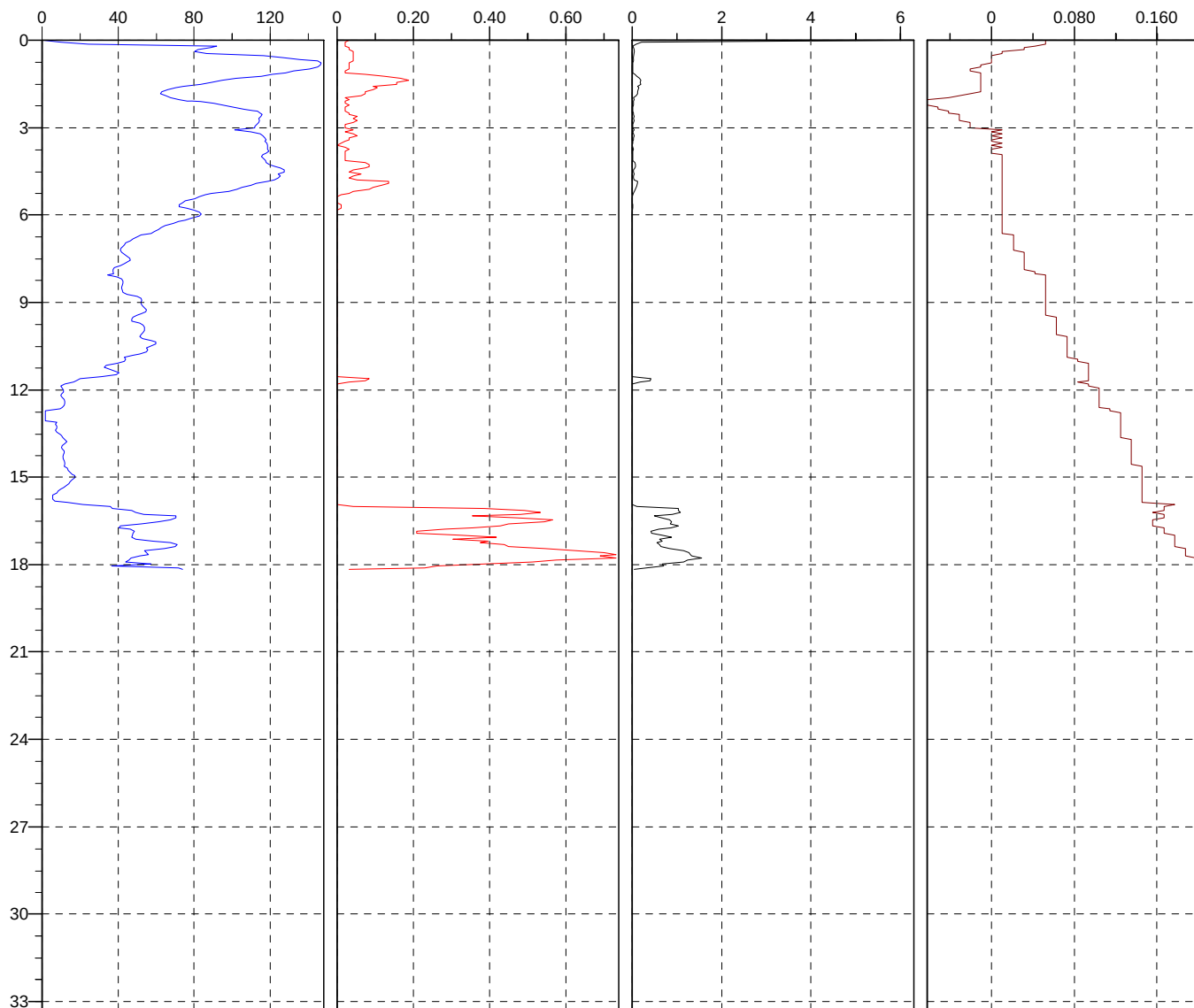
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qc [TSF]

fs [TSF]

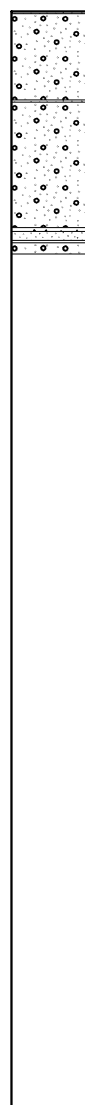
Rf [%]

u2 [TSF]



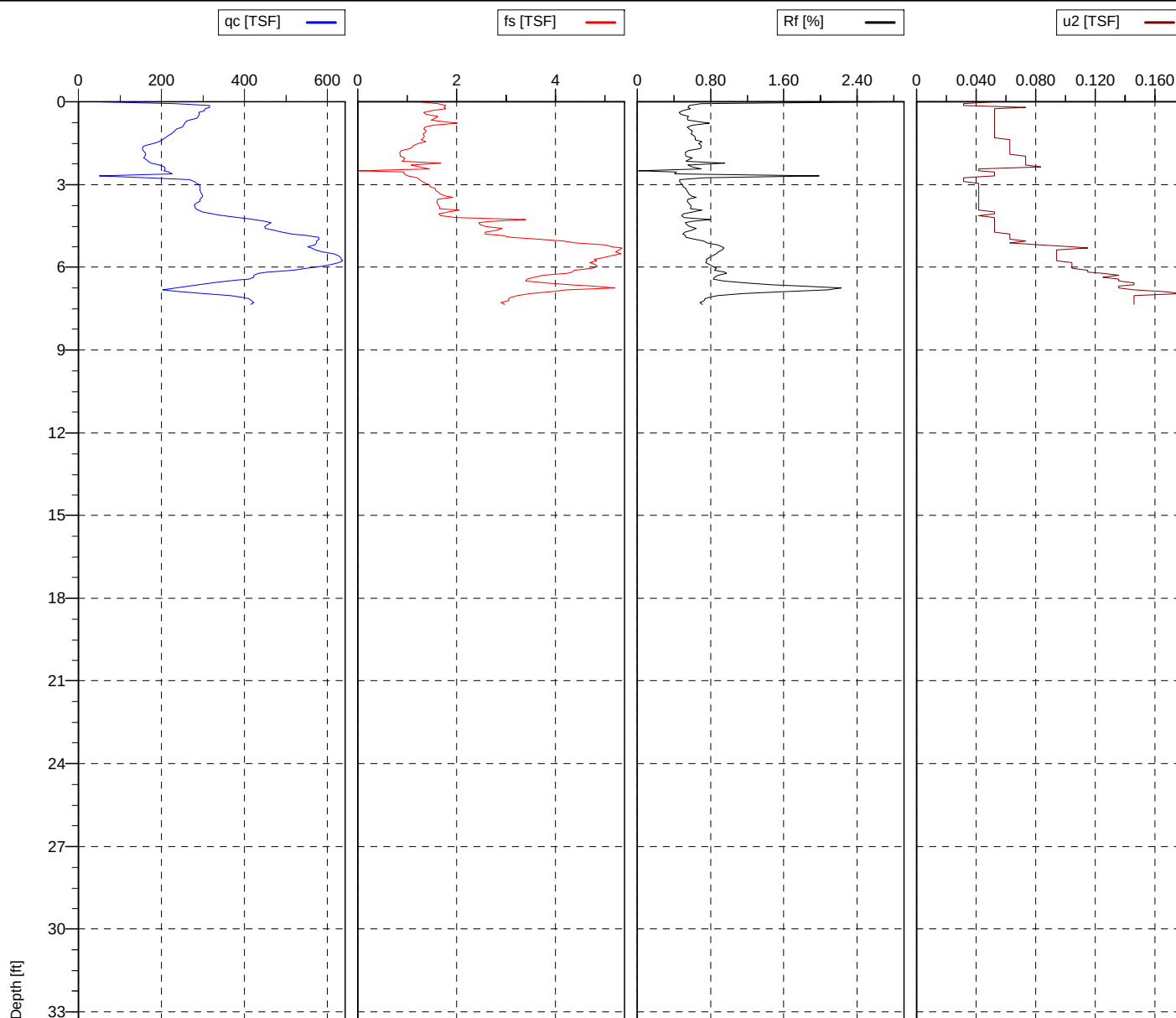
Cone No: 0
Tip area [cm²]: 10
Sleeve area [cm²]: 150

Location:	PRINCEVILLE	Position:	Ground level:	Test no:
Project ID:	CPT-B15	Client:	Date: 6/29/2006	Scale: 1 : 70
Project:	PRINCEVILLE FLOOD REDUCTION		Page: 1/1	Fig:
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.			File: pv\lle flood reduction B15.CPT	



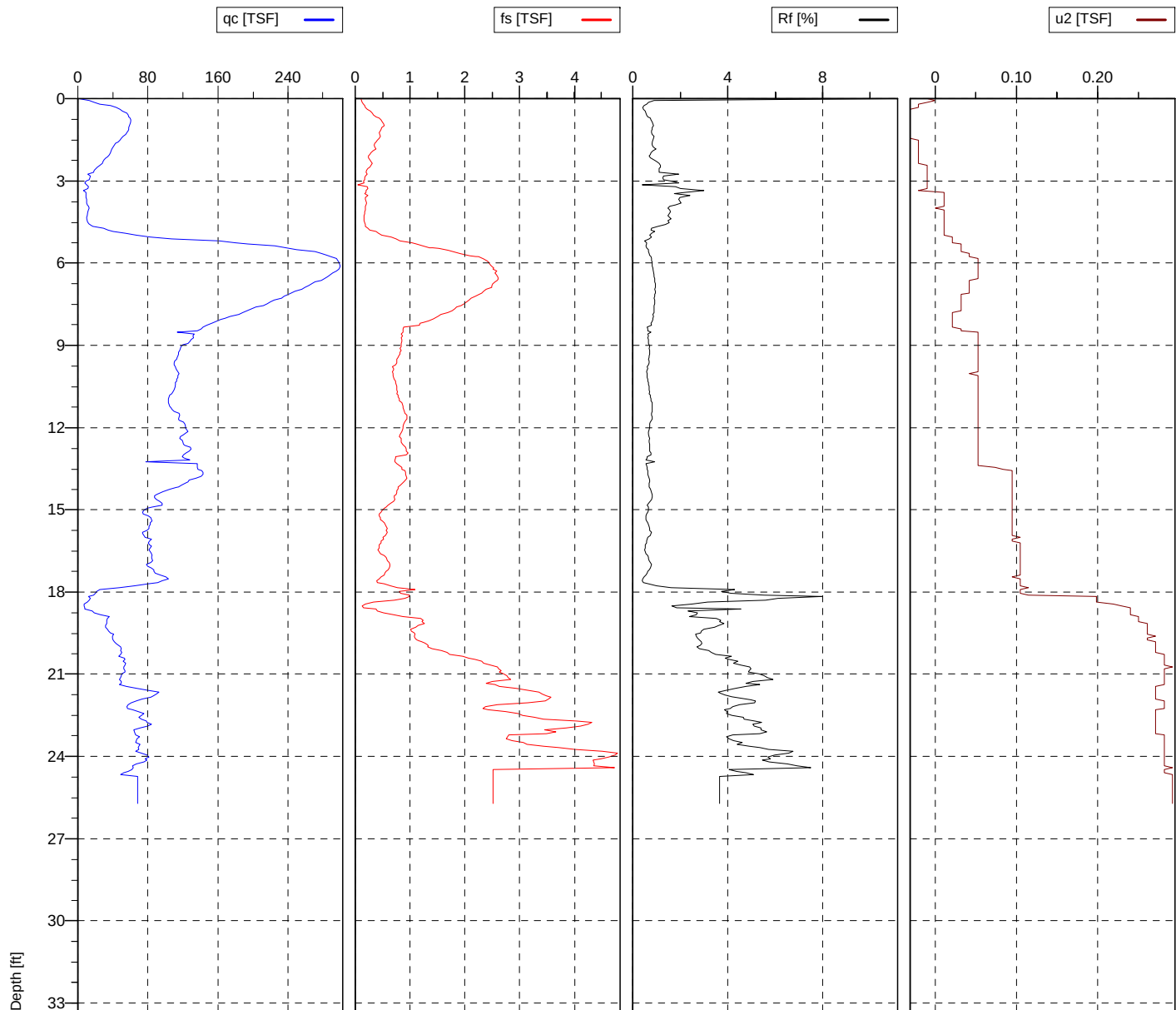
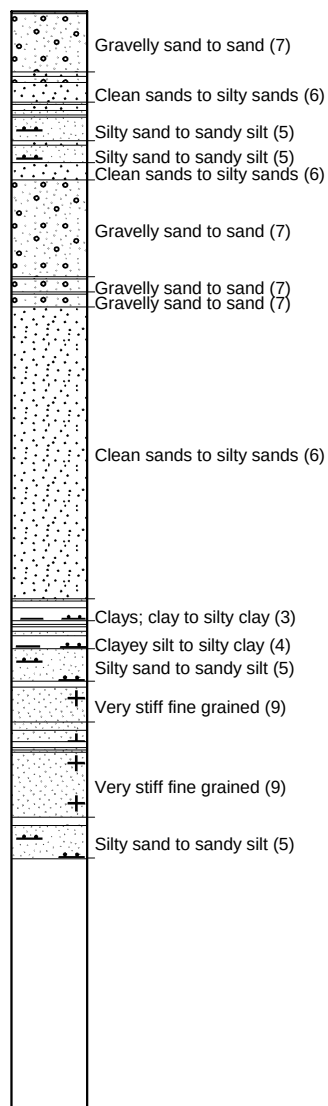
Gravelly sand to sand (7)

Gravelly sand to sand (7)



Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	PRINCEVILLE	Position:		Ground level:	Test no:
Project ID:	CPT-B6	Client:		Date:	Scale:
Project:	PRINCEVILLE FLOOD REDUCTION			6/28/2006	1 : 70
				Page:	Fig:
				1/1	
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.				File: pville flood reduction.CPT	



Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

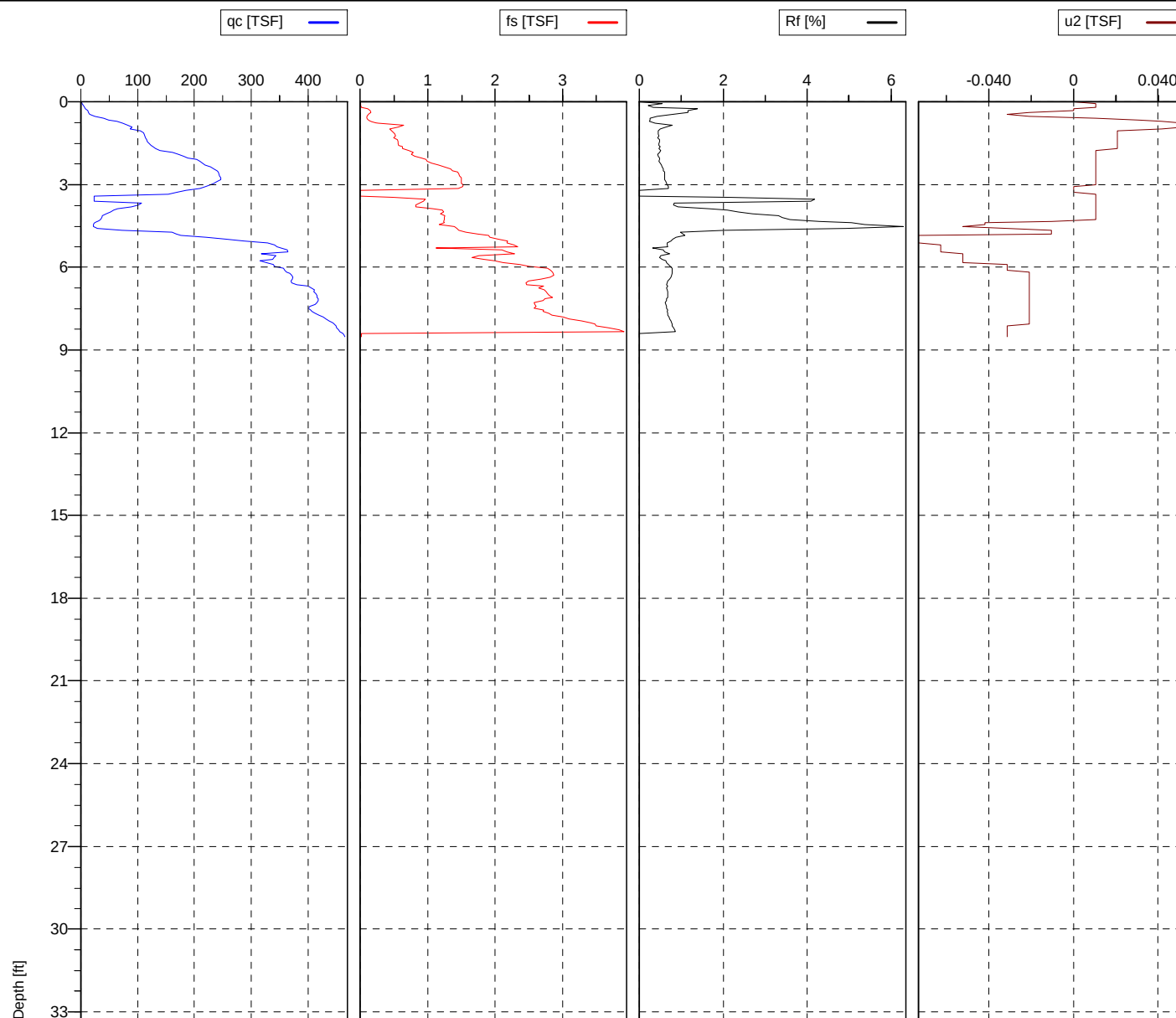
Location:	PRINCEVILLE	Position:		Ground level:	Test no:	
Project ID:	CPT-B4	Client:		Date:	Scale:	
Project:	PRINCEVILLE FLOOD REDUCTION			6/28/2006	1 : 70	
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.				Page:	Fig:	
				1/1		
				File:		
				prville flood reduction B4.CPT		



Gravelly sand to sand (7)

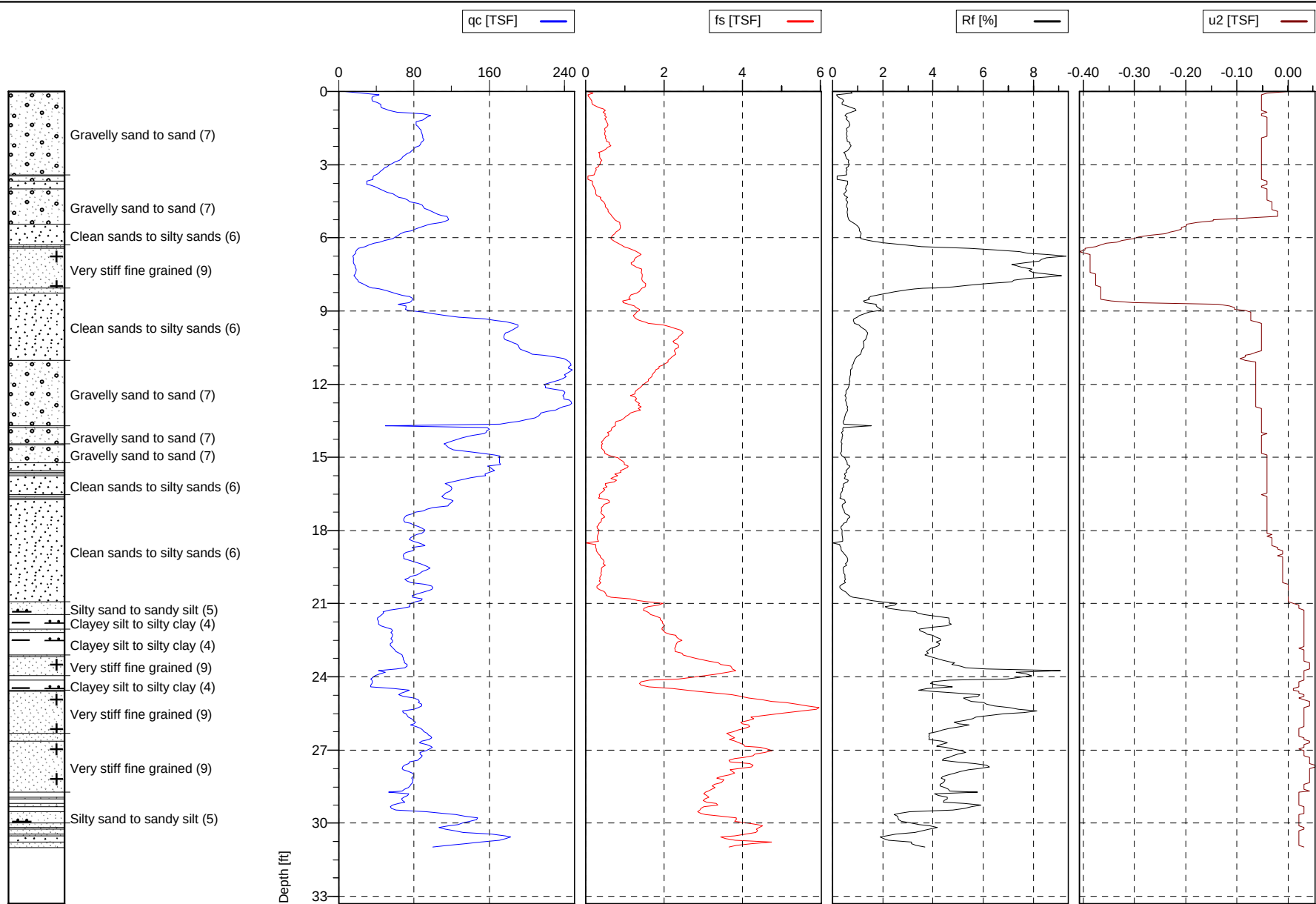
Very stiff sand to clayey sand (8)

Gravelly sand to sand (7)



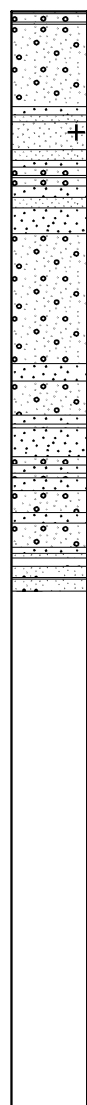
Cone No: 0
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	PRINCEVILLE	Position:		Ground level:	Test no:
Project ID:	CPT-B3	Client:		Date:	Scale:
Project:	PRINCEVILLE FLOOD REDUCTION			6/28/2006	1 : 70
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.				Page:	Fig:
				1/1	
				prville flood reduction B3.CPT	

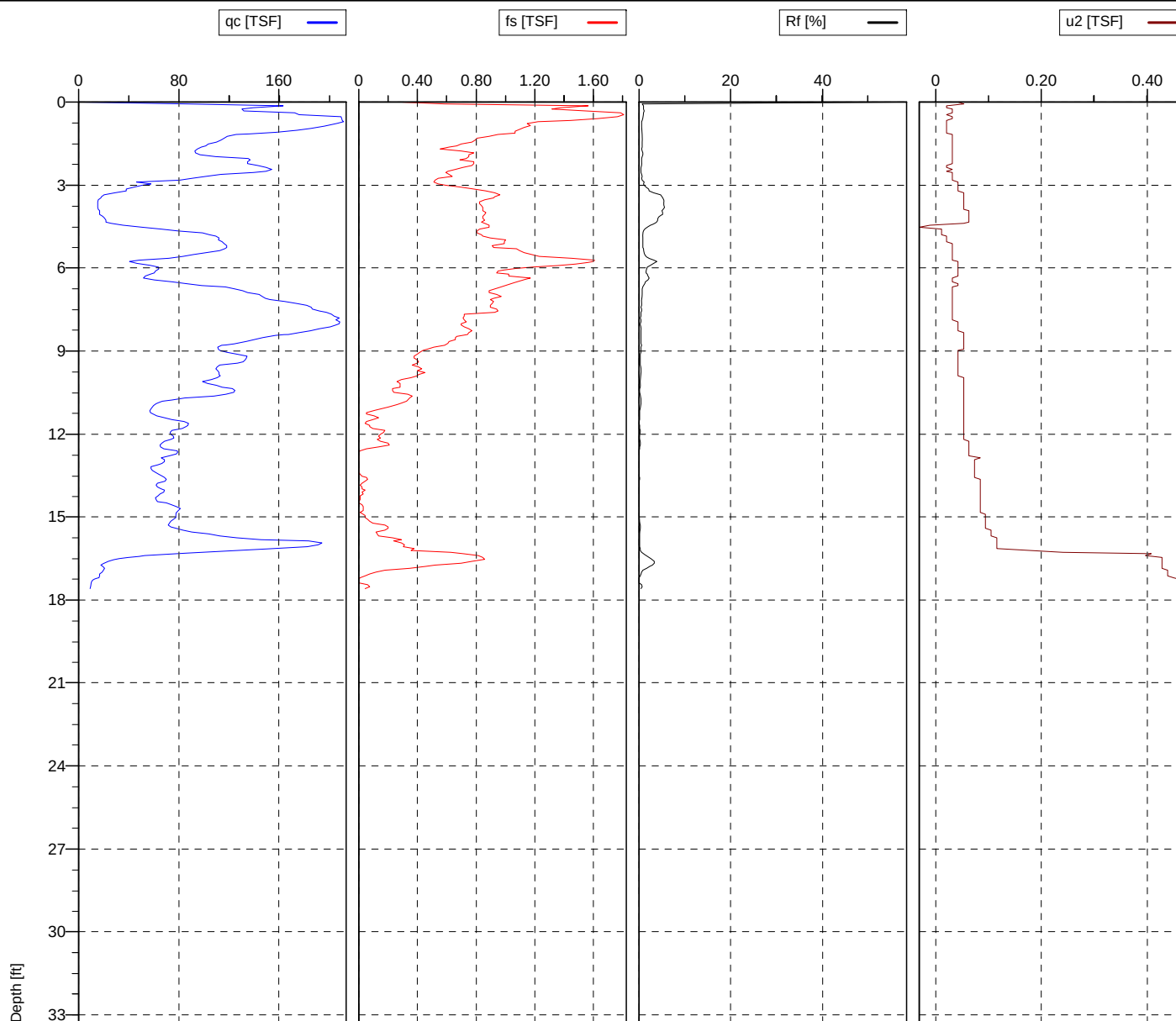


Cone No: 0
 Tip area [cm²]: 10
 Sleeve area [cm²]: 150

Location:	PRINCEVILLE	Position:		Ground level:	Test no:
Project ID:	CPT-B2	Client:		Date:	Scale:
Project:	PRINCEVILLE FLOOD REDUCTION			6/28/2006	1 : 70
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.				Page:	Fig:
				1/1	
				File:	
				pyville flood reduction B2.CPT	



Gravelly sand to sand (7)
 Very stiff fine grained (9)
 Clean sands to silty sands (6)
 Gravelly sand to sand (7)
 Clean sands to silty sands (6)
 Gravelly sand to sand (7)
 Clean sands to silty sands (6)
 Clean sands to silty sands (6)
 Gravelly sand to sand (7)
 Gravelly sand to sand (7)



Cone No: 0
 Tip area [cm2]: 10
 Sleeve area [cm2]: 150

Location:	PRINCEVILLE	Position:		Ground level:	Test no:
Project ID:	CPT-B16	Client:		Date: 6/29/2006	Scale: 1 : 70
Project:	PRINCEVILLE FLOOD REDUCTION			Page: 1/1	Fig:
USACE, SAVANNAH DISTRICT HTRW AND GEOTECHNICAL BRANCH. SOIL CLASSIFICATION BY ROBERTSON 1990.				File: pv\lle flood reduction B16.CPT	

Boring Designation PD-BP-64-1

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS										
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL										
2. HOLE NUMBER PD-BP-64-1				LOCATION COORDINATES 35.87415°N -77.52834°W		11. MANUFACTURER'S DESIGNATION OF DRILL CME-75										
3. DRILLING AGENCY				12. TOTAL SAMPLES 20		DISTURBED : UNDISTURBED 0										
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES												
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING										
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER 31.5												
7. DEPTH DRILLED INTO ROCK				15. DATE BORING 4/18/09												
8. TOTAL DEPTH OF BORING 30.0				16. ELEVATION TOP OF BORING 50.0												
				17. TOTAL CORE RECOVERY FOR BORING N/A												
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates												
ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory				REMARKS			
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
48.5	1.5	1				0' to 1.5': SAND, fine grained, some silt, trace of silt, trace of organics, roots, dark brown (SM)		1								0.0
		2														
		3														
		4	5			1.5' to 4.5': SAND, fine grained, some silt, trace of clay, brown (SM)		2	0	77	23			12	SM	2.5
		2														
		2	4													
45.5	4.5	4						3								
		7	8			4.5' to 7.5': SAND, poorly sorted, medium grained, little silt, light brown (SP)		4								5.0
		6														
		6														
		3	12					5								
42.5	7.5	4														
		6	8			7.5' to 10.5': SAND, poorly sorted, medium grained, little silt, trace of clay, moist, light brown (SP)		6								7.5
		6														
		6														
		5	12					7								10.0
39.5	10.5	6														
		7	12			10.5' to 12': SAND, poorly sorted, fine grained, little clay, trace of silt, dry, light brown (SP)		8								
38.0	12.0	11														
		7	18			12' to 13.5': SAND, poorly sorted, fine grained, trace of silt, trace of clay, light brown (SP)		9	0	79	21			9	SM	12.5
36.5	13.5	9														
		5	18			13.5' to 15': SAND, poorly sorted, fine grained, little silt, trace of clay, light brown (SP)		10								
35.0	15.0	8														
		10	13			15' to 16.5': SAND, poorly sorted, fine grained, little silt, light brown (SP)		11								15.0
33.5	16.5	13														
		10	24			16.5' to 18': SAND, poorly sorted, fine grained, trace of clay, moist, light gray (SP)		12								
32.0	18.0	10														
		3	20			18' to 19.5': SAND, poorly sorted, fine and medium grained, trace of clay, trace of silt, wet, light brown (SP)		13								
30.5	19.5	5														
		7														
		2	12			19.5' to 21': SAND, poorly sorted, fine and medium grained, little silt, trace of clay, light brown (SP)		14								20.0
29.0	21.0	4														
		5														
		1	9			21' to 24': SAND, poorly sorted, fine to coarse grained, trace of silt, light brown (SP)		15						17		
		1														
		1														
		2	2					16								22.5
26.0	24.0	3														
		4														
		2	7					17								25.0
		3														

Depth to groundwater static at 19.3 feet after 24 hours

DRILLING LOG (Cont Sheet)		INSTALLATION Wilmington District		SHEET 2 OF 2 SHEETS
PROJECT Princeville Dike, Princeville, NC		COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL
LOCATION COORDINATES		ELEVATION TOP OF BORING 50.0		

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
24.5	25.5	3	6		24' to 25.5': SAND, poorly sorted, fine to coarse grained, light brown (SP) (continued)										
		2													
23.0	27.0	1			25.5' to 27': SAND, poorly sorted, fine to coarse grained, trace of silt, trace of organics, light brown (SP)		18		4	91	5		14		SP
		2													
21.5	28.5	18	3		27' to 28.5': SAND, poorly sorted, fine to coarse grained, trace of clay, light brown (SP)		19	4	91	5		14	SP		
		12													
		5	30		fine to coarse grained, trace of clay, light brown (SP)		20								
		7													
20.0	30.0	10			28.5' to 30': SAND, poorly sorted, fine to coarse grained, trace of clay, gray (SP)										
17															

Cemented hole with three (3) bags of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08 GDT 11/10/09

Boring Designation PD-BP-64-2

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL	
2. HOLE NUMBER PD-BP-64-2				LOCATION COORDINATES 35.87506°N -77.52852°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED : 20 UNDISTURBED : 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL : BEARING		14. ELEVATION GROUND WATER 34.0	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING 45.0		15. DATE BORING : STARTED 4/18/09 : COMPLETED 4/18/09	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A			
8. TOTAL DEPTH OF BORING 30.0				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No	Laboratory							REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
44.0	1.0	1			0' to 1': SAND, fine grained, some silt, trace of organics, roots, dark brown (SM)		1								0.0
43.5	1.5	2													
		4	6		1' to 1.5': SAND, fine grained, some clay, trace of silt, light brown (SC)		2	2	70	28			10	SC	2.5
42.0	3.0	4			1.5' to 3': SAND, medium grained, some clay, trace of silt, light brown (SC)		3								
		8	12												
40.5	4.5	13			3' to 4.5': SAND, fine grained, some silt, little clay, dark brown (SM)		4	0	61	39			10	SM	5.0
		13			4.5' to 6': SAND, poorly sorted, fine grained, little silt, dark brown (SM)		5						15	SC	
39.0	6.0	8	27		6' to 7.5': SAND, poorly sorted, fine grained, little silt, reddish brown/gray (SC)		6								7.5
		4	7												
37.5	7.5	3			7.5' to 9': SAND, poorly sorted, medium grained, little clay, reddish brown/gray (SP)		7								10.0
		4	7												
36.0	9.0	2			9' to 10.5': SAND, poorly sorted, fine and medium grained, moist, light brown (SP)		8								12.5
		3	11												
34.5	10.5	5			10.5' to 12': SAND, poorly sorted, fine and medium grained, trace of silt, wet, light brown (SP)		9								15.0
		6													
33.0	12.0	4			12' to 13.5': SAND, poorly sorted, fine to coarse grained, trace of silt, light brown (SP)		10								17.5
		1	7												
31.5	13.5	1			13.5' to 15': SAND, poorly sorted, fine to coarse grained, trace of silt, trace of gravel 1/4" diameter, light brown (SP)		11	3	94	3			16	SP	20.0
		2	2												
30.0	15.0	3			15' to 17.5': SAND, poorly sorted, fine to coarse grained, trace of silt, light brown (SP)		12								22.5
		1	5												
27.5	17.5	3			17.5' to 18': SAND, poorly sorted, medium grained, trace of clay, light gray (SP)		13								25.0
		5	8												
27.0	18.0	6			18' to 19.5': SAND, poorly sorted, fine to medium grained, trace of clay, light brown/light gray (SP)		14			19			18	SC	
		12	15												
25.5	19.5	1			19.5' to 21': SAND, fine grained, with clay, trace of silt, dry, greenish gray (SC)		15								
		5	18												
24.0	21.0	10			21' to 30': CLAY, stiff, medium plasticity, little fine grained sand, trace of silt, greenish gray (CL)		16			88			19	CL	
		11	15												
		20	41												
		21													
		9	33												
		15	30												
		18													
		9													
		13													
		17													
		8													
		15													

Depth to groundwater static at 16.4 feet after 24 hours

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

DRILLING LOG (Cont Sheet)					INSTALLATION Wilmington District			SHEET 2 OF 2 SHEETS	
PROJECT Princeville Dike, Princeville, NC					COORDINATE SYSTEM Geographic			HORIZONTAL VERTICAL	
LOCATION COORDINATES					ELEVATION TOP OF BORING 45.0				

ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory						REMARKS
									Gravel	Sand	Fines	LL	PI	MC	
		20				21' to 30': CLAY, stiff, medium plasticity, little fine grained sand, trace of silt, greenish gray (CL) (continued)									
		7	35												
		13													
		18													
		20	31												
		24													
		28													
		29	52												
		29													
15.0	30.0	31													

60

Cemented hole with three (3) bags of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-64-3

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-64-3				LOCATION COORDINATES 35.87528°N -77.52822°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		42.0	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED 4/18/09 COMPLETED 4/18/09	
8. TOTAL DEPTH OF BORING 15.0				16. ELEVATION TOP OF BORING		48.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR		Stacey Smith/M. Gates	

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory						REMARKS	
								Gravel	Sand	Fines	LL	PI	MC		ASTM Class
46.5	1.5	1 2 3			0' to 1.5': SAND, fine grained, some silt, trace of organics, roots, brown (SM)		1								Depth to groundwater static at 9.6 feet after 24 hours
45.0	3.0	3 3 2	5		1.5' to 3': SAND, fine grained, some clay, trace of silt, roots, light brown (SC)		2								
		1 2 3	5		3' to 5.5': SAND, fine grained, some clay, trace of silt, light brown (SC)		3	0	56	44			15	SC	
42.5	5.5	3	5				4								
42.0	6.0	5			5.5' to 6': SAND, poorly sorted, medium grained, little clay, moist, light gray (SP)		5	1	95	4			21	SP	
39.5	8.5	1 2 2	8		6' to 8.5': SAND, poorly sorted, medium grained, little clay, wet, light brown (SP)		6								
39.0	9.0	1	4				7								
		2 3 5	2		8.5' to 9': CLAY, stiff, medium plasticity, trace of silt, green (CL)		8				40	25		CL	
37.5	10.5	3 4	8		9' to 10.5': CLAY, stiff, medium plasticity, little fine grained sand, trace of silt, woody fragments, green (CL)		9	0	81	19			22	SP	
36.0	12.0	4 5	9		10.5' to 12': SAND, poorly sorted, little clay, woody fragments, light gray (SP)		10				34	15		CL	
34.5	13.5	4 8 12	20		12' to 13.5': SAND, poorly sorted, little clay, light gray (SP)										
33.0	15.0	6 7 11			13.5' to 15': CLAY, stiff, medium plasticity, some fine grained sand, light gray (CL)										

Depth to groundwater static at 9.6 feet after 24 hours

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-BA-1

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-BA-1				LOCATION COORDINATES 35.85738°N -77.46433°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		27.5	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED 4/14/09	
8. TOTAL DEPTH OF BORING 15.0				16. ELEVATION TOP OF BORING		35.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N _t	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
33.5	1.5	1				0' to 1.5': SAND, fine grained, some silt, trace of clay, trace organics, brown (SM)		1						8		Depth to groundwater static at 6.1 feet after 24 hours
32.0	3.0	1	2			1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, light reddish brown (SP)		2								
29.0	6.0	2	2			3' to 6': SAND, poorly sorted, fine grained, trace of clay, moist, light reddish brown (SP)		3								
		2	4					4								
		3														
26.0	9.0	2	7			6' to 9': SAND, poorly sorted, fine and medium grained, trace of clay, wet, light reddish brown (SP)		5								
		3						6								
		1	6													
24.5	10.5	2	4			9' to 10.5': SAND, poorly sorted, fine and medium grained, trace of clay, light reddish brown (SP)		7	0	91	9			24	SP-SC	
		3						8								
		2	5													
21.5	13.5	1	7			10.5' to 13.5': SAND, poorly sorted, fine and medium grained, trace of clay, light brown (SP)		9								
		1														
		1														
20.0	15.0	2	2			13.5' to 15': SAND, poorly sorted, fine to coarse grained, light brown (SP)										
		3						10						23		
		4														

Backfilled hole with cuttings and surrounding material.

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-BA-2

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL	
2. HOLE NUMBER PD-BP-BA-2				LOCATION COORDINATES 35.85638°N -77.4631°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED : 10 UNDISTURBED : 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL : ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		27.0	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED : 4/14/09 COMPLETED : 4/14/09	
8. TOTAL DEPTH OF BORING 15.0				16. ELEVATION TOP OF BORING		35.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N ₁	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class		
33.5	1.5	1 1 2				0' to 1.5': SAND, fine grained, some silt, trace of clay, trace of organics, brown (SM)		1									Depth to groundwater static at 5.3 feet after 24 hours
32.0	3.0	1 2	3			1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, light reddish brown (SP)		2									
30.5	4.5	1 2 1	3			3' to 4.5': SAND, poorly sorted, fine grained, trace of clay, moist, light reddish brown (SP)		3	0	68	32			14	SC		
29.0	6.0	2 4 3	3			4.5' to 6': SAND, poorly sorted, fine grained, trace of clay, wet, light reddish brown (SP)		4									
26.0	9.0	3 3 2	7			6' to 9': SAND, poorly sorted, fine grained, trace of clay, wet, light gray (SP)		5									
		2 2 1	5				6										
		3 3 4	3				7					22					
24.5	10.5	1 1 1	7			10.5' to 12': SAND, fine and medium grained, poorly sorted, trace of clay, light gray/ light brown (SP)		8									
23.0	12.0	2 3 5	2			12' to 13.5': SAND, poorly sorted, fine to medium grained, light brown (SP)		9	0	98	2			21	SP		
21.5	13.5	1 1 2	8			13.5' to 15': SAND, poorly sorted, fine to coarse grained, light brown (SP)		10									

Backfilled hole with cuttings and surrounding material.

Boring Designation PD-BP-BA-3

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-BA-3				LOCATION COORDINATES 35.85683°N -77.46146°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		26.6	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED 4/14/09 COMPLETED 4/14/09	
8. TOTAL DEPTH OF BORING 15.0				16. ELEVATION TOP OF BORING		35.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory						REMARKS									
									Gravel	Sand	Fines	LL	PI	MC		ASTM Class								
33.5	1.5	2 3 4				0' to 1.5': SAND, fine grained, some silt, trace of clay, trace of organics, brown (SM)		1			19			2	SM	Depth to groundwater static at 5.4 feet after 24 hours								
32.0	3.0	3 3 3	7			1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, light reddish brown (SP)		2									Depth to groundwater static at 5.4 feet after 24 hours							
30.5	4.5	2 2 2	6			3' to 4.5': SAND, poorly sorted, fine grained, trace of clay, light reddish brown (SP)		3	0	93	8			6	SP-SC			Depth to groundwater static at 5.4 feet after 24 hours						
27.5	7.5	2 2 3	4			4.5' to 7.5': SAND, poorly sorted, fine grained, trace of clay, moist, light brown (SP)		4											Depth to groundwater static at 5.4 feet after 24 hours					
		2 3 4	5				5								Depth to groundwater static at 5.4 feet after 24 hours									
26.0	9.0	2 2 3	7			7.5' to 9': SAND, poorly sorted, fine grained, trace of clay, wet, light brown (SP)		6													Depth to groundwater static at 5.4 feet after 24 hours			
24.5	10.5	1 1 1	5			9' to 10.5': SAND, fine grained, poorly sorted, trace of clay, light brown (SP)		7														Depth to groundwater static at 5.4 feet after 24 hours		
21.5	13.5	2 2 2	2			10.5' to 13.5': SAND, poorly sorted, fine and medium grained, little clay, light gray/light brown (SP)		8															Depth to groundwater static at 5.4 feet after 24 hours	
		1 2 3	4				9	0	89	11			20	SP-SC						Depth to groundwater static at 5.4 feet after 24 hours				
20.0	15.0	1 1 1	5			13.5' to 15': SAND, poorly sorted, fine and medium grained, light brown (SP)		10																

Backfilled hole with cuttings and surrounding material.

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-BA-4

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-BA-4				LOCATION COORDINATES 35.85793°N -77.46055°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		27.0	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED 4/15/09 COMPLETED 4/15/09	
8. TOTAL DEPTH OF BORING 15.0				16. ELEVATION TOP OF BORING		35.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	N ₉₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
33.5	1.5	0 1 1				0' to 1.5': SAND, fine grained, some silt, little clay, trace of clay, trace of organics, roots, brown (SM)		1			15			7	SM	0.0
		2 2 4	2			1.5' to 4.5': SAND, fine grained, poorly sorted, trace of silt, light brown (SP)		2								2.5
30.5	4.5	3 2 2	6					3	0	84	16			10	SM	
29.0	6.0	2 2 2	4			4.5' to 6': SAND, poorly sorted, fine grained, little clay, moist, light gray (SP)		4								5.0
		2 2 2	4			6' to 9': SAND, poorly sorted, fine grained, little clay, wet, light gray (SP)		5								7.5
26.0	9.0	2 1 2	4					6								
		2 2 3	3			9' to 10.5': SAND, poorly sorted, fine grained, little clay (SP)		7								10.0
24.5	10.5	3 3 4	5			10.5' to 12': SAND, poorly sorted, fine to coarse grained, little clay, light gray/ light brown (SP)		8	0	83	17			22	SC	
23.0	12.0	3 4 4	7			12' to 15': SAND, poorly sorted, fine to coarse grained, light brown (SP)		9								12.5
20.0	15.0	4 4 5	8					10						16		15.0

Depth to groundwater static at 5.0 feet after 24 hours

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-BA-5

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-BA-5				LOCATION COORDINATES 35.85814°N -77.46241°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER 27.0		15. DATE BORING STARTED 4/15/09 COMPLETED 4/15/09	
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING 35.0		17. TOTAL CORE RECOVERY FOR BORING N/A	
8. TOTAL DEPTH OF BORING 15.0				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N _i	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Laboratory								REMARKS
								Samp No.	Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
33.5	1.5	2 3 5				0' to 1.5': SAND, fine grained, some silt, trace of clay, trace of organics, brown (SM)		1			22			5	SM	Depth to groundwater static at 6.0 feet after 24 hours
32.0	3.0	2 2 3	8			1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, light brown (SP)		2								
30.5	4.5	3 3 3	5			3' to 4.5': SAND, poorly sorted, fine grained, trace of clay, light brown (SP)		3	0	84	16			8	SC	
29.0	6.0	4 2 2	6			4.5' to 6': SAND, poorly sorted, fine grained, little clay, light brown/light gray (SP)		4								
27.5	7.5	2 4 4	4			6' to 7.5': SAND, poorly sorted, fine grained, trace of clay, light brown/light gray (SP)		5								
26.0	9.0	3 2 3	8			7.5' to 9': SAND, poorly sorted, fine grained, trace of clay, wet, light brown/light gray (SP)		6								
		2 2 3	5			9' to 12': SAND, poorly sorted, fine and medium grained, trace of clay, light brown (SP)		7								
23.0	12.0	1 1 1	5					8	0	97	3			26	SP	
20.0	15.0	2 3 5 2 3 3 5	2 8			12' to 15': SAND, poorly sorted, fine to coarse grained, light brown (SP)		9 10								

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-1

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL	
2. HOLE NUMBER PD-BP-SS-1				LOCATION COORDINATES 35.89116°N -77.53258°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10 : UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES			
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL : BEARING		14. ELEVATION GROUND WATER 26.0	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING 34.0		15. DATE BORING : STARTED 4/15/09 : COMPLETED 4/15/09	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates	
8. TOTAL DEPTH OF BORING 15.0							

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
32.5	1.5	1 1 3			0' to 1.5': SAND, medium grained, some silt, little clay, trace of organics, roots, reddish brown (SM)		1			13			5	SM	Depth to groundwater static at 5.1 feet after 24 hours
31.0	3.0	7 8 10	4		1.5' to 3': SAND, poorly sorted, medium grained, little clay, trace of silt, light brown (SP)		2								
29.5	4.5	10 6 9	18		3' to 4.5': SAND, poorly sorted, medium grained, little clay, trace of silt, reddish brown (SP)		3	2	85	14			9	SC	
28.5	5.5	7 4	15		4.5' to 5.5': SAND, poorly sorted, fine grained, trace of clay, reddish brown (SP)		4								
28.0	6.0	5			5.5' to 6': CLAY, stiff, low plasticity, little silt, little fine grained sand, light gray (CL)		5				32	15		CL	
26.5	7.5	2 3 6	9		6' to 7.5': CLAY, stiff, low plasticity, some fine grained sand (CL)		6								
25.0	9.0	4 4 5	9		7.5' to 9': SAND, poorly sorted, medium grained, little clay (SP)		7								
		2 2 3	9		9' to 12': SAND, poorly sorted, medium grained, trace of clay (SP)		8	1	90	9			15	SP-SC	
22.0	12.0	3 3 4	5												
20.5	13.5	4 4 4	7		12' to 13.5': SAND, poorly sorted, medium grained, trace of clay, trace of pebbles 3/4" diameter, light gray (SP)		9								
19.0	15.0	4 4 5	8		13.5' to 15': SAND, poorly sorted, medium grained, trace of clay, light gray (SP)		10								

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-2

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS												
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL												
2. HOLE NUMBER : LOCATION COORDINATES PD-BP-SS-2 : 35.89119°N -77.53276°W				10. SIZE AND TYPE OF BIT														
3. DRILLING AGENCY				11. MANUFACTURER'S DESIGNATION OF DRILL CME-75														
4. NAME OF DRILLER E. Woods				12. TOTAL SAMPLES : DISTURBED : UNDISTURBED 20 : 0														
5. DIRECTION OF BORING : DEG FROM VERTICAL : BEARING ☒ VERTICAL : --- : ☐ INCLINED				13. TOTAL NUMBER CORE BOXES														
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER 27.0														
7. DEPTH DRILLED INTO ROCK				15. DATE BORING : STARTED : COMPLETED 4/15/09 : 4/15/09														
8. TOTAL DEPTH OF BORING 30.0				16. ELEVATION TOP OF BORING 49.0														
				17. TOTAL CORE RECOVERY FOR BORING N/A														
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates														
ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS	
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class			
47.5	1.5	2				0' to 1.5': SAND, fine grained, some clay, trace of silt, trace of gravel 3/4" diameter, reddish brown (SC)		1									0.0	
		6				1.5' to 6': SAND, fine grained, some clay, trace of silt, reddish brown (SC)		2	0	60	41				11	SC	2.5	
		5	12						3									
		5	10						4									5.0
43.0	6.0	6																
		6	11															
		6																
41.5	7.5	2	12			6' to 7.5': CLAY, soft, low plasticity, some fine grained sand, trace of silt, brown (CL)		5				27	12		CL		7.5	
		3				7.5' to 13.5': SAND, fine grained, some clay, trace of silt, brown (SC)		6										
		6	9						7									10.0
		4	8															
		4																
		4																
		4																
35.5	13.5	2	12					8	0	61	39			13	SC		12.5	
		3						9										
		3	6															
		3																
34.0	15.0	1	6			13.5' to 15': CLAY, stiff, medium plasticity, little fine grained sand, trace of silt, reddish brown (CL)		10				38	21		CL		15.0	
		2				15' to 19.5': SAND, poorly sorted, fine grained, trace of clay, light brown (SP)		11										
		2							12									17.5
		4	4						13									
		17																
		17																
		9	34															
		11																
		16																
29.5	19.5	13	27															
		16																
		20																
		13	36			19.5' to 21': SAND, poorly sorted, medium grained, little clay, moist, light brown (SP)		14									20.0	
28.0	21.0	16				21' to 22.5': SAND, poorly sorted, medium grained, little clay, wet, light brown (SP)		15										
		18																
		6	34															
		8																
26.5	22.5	10																
		3	18			22.5' to 25.5': SAND, poorly sorted, medium and coarse grained, light brown (SP)		16	2	96	2			15	SP		22.5	
		6																
		10																
		7	16															
		9						17									25.0	

Depth to groundwater static at 20.3 feet after 24 hours

DRILLING LOG (Cont Sheet)						INSTALLATION Wilmington District		SHEET 2 OF 2 SHEETS			
PROJECT Princeville Dike, Princeville, NC						COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL			
LOCATION COORDINATES						ELEVATION TOP OF BORING 49.0					
ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory	REMARKS	
									Gravel Sand Fines LL PI MC ASTM Class		
23.5	25.5	10									
		2	19			25.5' to 28.5': SAND, poorly sorted, medium and coarse grained, trace of clay, light brown (SP)					
		4					18				
		7									
		2	11								
		4									
20.5	28.5	6									
		3	10			28.5' to 30': SAND, poorly sorted, fine grained, trace of silt, light brown (SP)					
		5									
		12									
19.0	30.0										
17											
Cemented hole with three (3) bags of Portland											

25.0
27.5
30.0

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-3

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-3				LOCATION COORDINATES 35.8944°N -77.52269°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES 20		DISTURBED UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER 26.5	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF BORING 49.0		17. TOTAL CORE RECOVERY FOR BORING N/A	
7. DEPTH DRILLED INTO ROCK				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates		15. DATE BORING STARTED 4/15/09 COMPLETED 4/16/09	
8. TOTAL DEPTH OF BORING 30.0							

ELEV	DEPTH	Blows/ 0.5 ft	N _t	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory						REMARKS	
									Gravel	Sand	Fines	LL	PL	MC		ASTM Class
47.5	1.5	3				0' to 1.5': CLAY, stiff, low plasticity, some fine grained sand, trace of silt, trace of gravel 3/4" diameter, reddish brown (CL)		1				35	19		CL	0.0
46.0	3.0	8	10			1.5' to 3': SAND, poorly sorted, fine grained, trace of clay, reddish brown (SP)		2								2.5
		11				3' to 9': SAND, poorly sorted, fine and medium grained, trace of clay, reddish brown (SP)		3								5.0
		9	19					4								7.5
		9						5								
		15	18					6								
		13														
		14														
		17	27													
		19														
		22														
		20	41													
		13														
40.0	9.0	17				9' to 12': SAND, poorly sorted, fine and medium grained, trace of clay, trace of silt, reddish brown (SP)		7	4	89	8			5	SP-SC	10.0
		13	30					8								
		15														
		10														
		12	25													
		12														
37.0	12.0	13				12' to 13.5': SAND, poorly sorted, fine grained, trace of clay, trace of silt, reddish brown (SP)		9								12.5
		5	25													
		6														
		7														
35.5	13.5					13.5' to 15': SAND, poorly sorted, fine and medium grained, trace of clay, light gray (SP)		10								15.0
		4	13													
		10														
		16														
34.0	15.0					15' to 16.5': SAND, poorly sorted, fine and medium grained, trace of clay, moist, light gray (SP)		11								17.5
		8	26													
		13														
		19														
		9	32			16.5' to 18': SAND, poorly sorted, fine grained, trace of clay, wet, light gray (SP)		12								
		16														
		20														
		9	36			18' to 21': SAND, poorly sorted, fine grained, little clay, light gray (SP)		13								
		11														
		18														
		11	29													
		8														
		6														
28.0	21.0															
		2	14			21' to 22.5': CLAY, stiff, medium plasticity, some fine grained sand, trace of silt, light gray (CL)		15								
		3														
		4														
26.5	22.5					22.5' to 24': CLAY, stiff, medium plasticity, some coarse grained sand, trace of silt, light gray (CL)		16				40	22		CL	22.5
		1	7													
		2														
		8														
25.0	24.0					24' to 25.5': SAND, poorly sorted, coarse grained, little clay, gray (SP)		17								
		11	10													
		12														

Depth to groundwater static at 17.7 feet after 24 hours

DRILLING LOG (Cont Sheet)		INSTALLATION Wilmington District		SHEET 2 OF 2 SHEETS	
PROJECT Princeville Dike, Princeville, NC		COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
LOCATION COORDINATES		ELEVATION TOP OF BORING 49.0			

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
23.5	25.5	9													
		4	21		25.5' to 27': CLAY, stiff, medium plasticity, little fine grained sand, gray (CL)		18						21		
22.0	27.0	10													
		7	16		27' to 28.5': SAND, fine grained, some clay, gray (SC)		19			25			13	SC	
20.5	28.5	14													
		10	28		28.5' to 30': SAND, poorly sorted, fine grained, little clay, light gray (SP)		20								
19.0	30.0	15													

30

Cemented hole with three (3) bags of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-4

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS											
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL : VERTICAL											
2. HOLE NUMBER PD-BP-SS-4				LOCATION COORDINATES 35.89439°N -77.5232°W		10. SIZE AND TYPE OF BIT											
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED : 20 UNDISTURBED : 0											
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES													
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL : ---		BEARING											
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		25.0											
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED : 4/16/09 COMPLETED : 4/16/09											
8. TOTAL DEPTH OF BORING 30.0				16. ELEVATION TOP OF BORING		49.0											
				17. TOTAL CORE RECOVERY FOR BORING		N/A											
				18. SIGNATURE AND TITLE OF INSPECTOR		Stacey Smith/M. Gates											
ELEV	DEPTH	Blows/ 0.5 ft	N ₁	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS
									Gravel	Sand	Fines	LI	PI	MC	ASTM Class		
47.5	1.5	2				0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1									0.0
		5															
		5															
46.0	3.0	7	10			1.5' to 3': SAND, fine grained, some clay, trace of silt, reddish brown (SC)		2									2.5
		7															
		8															
		5	15			3' to 9': SAND, fine grained, some clay, little silt, brown (SC)		3									
		8															
		10															
		6	18					4	0	59	41			10	SC		5.0
		6															
		6															
		4	12					5									
		4															
		6															
		3	10					6									
		5															
		7															
40.0	9.0	7															
		5	12														
		7															
38.5	10.5	8	15			9' to 10.5': SAND, poorly sorted, fine grained, little clay, trace of silt, reddish brown (SP)		7									10.0
		10															
		11															
		7	21			10.5' to 15': SAND, poorly sorted, fine grained, trace of clay, trace of silt, light brown (SP)		8									
		7															
		7															
		7	14					9	0	82	18			8	SC		12.5
		8															
		11															
34.0	15.0	10	19			15' to 16.5': SAND, poorly sorted, fine grained, little clay, light brown (SP)		10									15.0
		16															
		17															
32.5	16.5	12	33			16.5' to 19.5': SAND, poorly sorted, fine grained, trace of clay, gray (SP)		11									
		17															
		18															
		6	35					12									
		9															
		10															
29.5	19.5	3	19			19.5' to 21': SAND, poorly sorted, little clay, trace of coal, gray (SP)		13									
		3															
		3															
28.0	21.0	2	6			21' to 22.5': CLAY, stiff, medium plasticity, some fine grained sand, roots, moist (CL)		14									20.0
		2															
		4															
26.5	22.5	3	6			22.5' to 24': SAND, poorly sorted, fine to coarse grained, little clay, bluish gray (SP)		15									
		6															
		8															
25.0	24.0	2	14					16									22.5
		4															
		4															
		4						17									25.0

Depth to groundwater static at 19.5 feet after 24 hours

DRILLING LOG (Cont Sheet)		INSTALLATION Wilmington District		SHEET 2 OF 2 SHEETS
PROJECT Princeville Dike, Princeville, NC		COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL
LOCATION COORDINATES		ELEVATION TOP OF BORING 49.0		

ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
23.5	25.5	4				24' to 25.5': SAND, poorly sorted, coarse grained, trace of clay, wet, gray/light brown (SP) (continued) 25.5' to 30': CLAY, stiff, low plasticity, little fine grained sand, roots, dry, gray (CL)										
		2	8													
		4														
		6														
		3	10													
		5														
		9														
	8	14														
	12															
19.0	30.0	14														

26

Cemented hole with three (3) bags of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-5

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 2 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-5				LOCATION COORDINATES 35.89474°N -77.52001°W		11. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 20	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER		27.0	
7. DEPTH DRILLED INTO ROCK				15. DATE BORING		STARTED 4/16/09	
8. TOTAL DEPTH OF BORING 30.0				16. ELEVATION TOP OF BORING		49.0	
				17. TOTAL CORE RECOVERY FOR BORING		N/A	
				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates		COMPLETED 4/17/09	

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class		
47.5	1.5	3			0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1									0.0
46.0	3.0	4	9		1.5' to 3': SAND, fine grained some clay, trace of silt, reddish brown (SC)		2									2.5
		5														
		4	10		3' to 9': SAND, fine grained some clay, trace of silt, brown (SC)		3									
		3														
		4	8				4	0	57	43			15	SC		5.0
		4														
		3	8				5									7.5
		4														
40.0	9.0	3					6									
		3														
38.5	10.5	1	6		9' to 10.5': SAND, fine grained, some clay, trace of silt, reddish brown (SC)		7									10.0
		2														
37.0	12.0	4	6		10.5' to 12': SAND, poorly sorted, fine grained, trace of silt, light brown (SP)		8									
		9														
35.5	13.5	8	19		12' to 13.5': SAND, poorly sorted, fine grained, little silt, brown (SP)		9									12.5
		8														
34.0	15.0	12	16		13.5' to 15': SAND, poorly sorted, fine grained, trace of silt, light brown (SP)		10	0	89	11			11	SP-SM		15.0
		16														
32.5	16.5	4	34		15' to 16.5': SAND, poorly sorted, fine grained, trace of clay, light gray (SP)		11									
		6														
31.0	18.0	1	10		16.5' to 18': SAND, fine grained, some clay, moist, gray (SC)		12									17.5
		1														
29.5	19.5	1	2		18' to 19.5': SAND, fine grained, some clay, gray (SC)		13			42			16	SC		
		2														
28.0	21.0	3	6		19.5' to 21': SAND, poorly sorted, little clay, light gray (SP)		14									20.0
		4														
26.5	22.5	4	10		21' to 22.5': SAND, poorly sorted, medium and fine grained, trace of clay, wet, light brown (SP)		15									22.5
		4														
25.0	24.0	4	8		22.5' to 24': SAND, poorly sorted, medium and fine grained, trace of clay, white (SP)		16									
		5														
		8														
		2	13				17	0	97	4			21	SP		25.0
		3														

Depth to groundwater static at 20.2 feet after 24 hours

DRILLING LOG (Cont Sheet)					INSTALLATION Wilmington District			SHEET 2 OF 2 SHEETS	
PROJECT Princeville Dike, Princeville, NC					COORDINATE SYSTEM Geographic			HORIZONTAL VERTICAL	
LOCATION COORDINATES					ELEVATION TOP OF BORING 49.0				

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory						REMARKS				
								Gravel	Sand	Fines	LL	PI	MC		ASTM Class			
23.5	25.5	2			24' to 25.5': SAND, poorly sorted, medium and fine grained, trace of clay, white/gray (SP) (continued)													
		1	5															
		2																
22.0	27.0	2				25.5' to 27': SAND, poorly sorted, fine grained, little clay, gray (SP)												
		2	4															
		2			27' to 28.5': SAND, fine grained, some clay, trace of silt, gray (SC)										16			
20.5	28.5	6																
		6	8															
		15			28.5' to 30': CLAY, stiff, medium plasticity, little fine grained sand, trace of silt, gray (CL)													
19.0	30.0	20																

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Cemented hole with three (3) bags of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-6

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-6				LOCATION COORDINATES 35.89429°N -77.52311°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				11. MANUFACTURER'S DESIGNATION OF DRILL CME-75		12. TOTAL SAMPLES DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER 30.0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				15. DATE BORING 4/17/09		STARTED COMPLETED 4/17/09	
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING 38.0		17. TOTAL CORE RECOVERY FOR BORING N/A	
8. TOTAL DEPTH OF BORING 15.0				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N _r	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class		
36.5	1.5	2				0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1			52				15	CL	Depth to groundwater static at 7.3 feet after 24 hours
		6	5			1.5' to 6': SAND, poorly sorted, fine and medium grained, trace of clay, light brown (SP)		2									
		12						3									
		10	27														
		10															
		13															
		14	23														
32.0	6.0	14						4	0	90	10			6	SP-SC		
		13	28			6' to 7.5': SAND, poorly sorted, fine and medium grained, trace of clay, moist, light brown (SP)		5									
		11															
		14						6									
29.0	9.0	6	25			7.5' to 9': SAND, poorly sorted, fine and medium grained, little clay, wet, light brown/gray (SP)											
		9															
		11															
		2	20			9' to 10.5': CLAY, soft, low plasticity, some fine grained sand, trace of silt, gray (CL)		7				29	11		CL		
		2															
27.5	10.5	2						8									
		1	4			10.5' to 12': CLAY, stiff, medium plasticity, some fine grained sand, trace of silt, gray (CL)											
		2															
26.0	12.0	2						9			40			15	SC		
		1	4			12' to 13.5': SAND, coarse and fine grained, some clay, trace of silt, gray (SC)											
		2															
24.5	13.5	8						10									
		5	10			13.5' to 15': SAND, coarse and fine grained, poorly sorted, little clay, gray (SP)											
		8															
23.0	15.0	9															

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08 GDT 11/10/09

Boring Designation PD-BP-SS-7

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-7				LOCATION COORDINATES 35.89432°N -77.52277°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				11. MANUFACTURER'S DESIGNATION OF DRILL CME-75		12. TOTAL SAMPLES DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER 37.0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				15. DATE BORING STARTED 4/17/09 COMPLETED 4/17/09		16. ELEVATION TOP OF BORING 45.0	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates	
8. TOTAL DEPTH OF BORING 15.0							

ELEV	DEPTH	Blows/ 0.5 ft	N ₁	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
									Gravel	Sand	Fines	LL	PI	MC	ASTM Class	
43.5	1.5	1 1 4				0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1			20			8	SC	Depth to groundwater static at 7.3 feet after 24 hours
		7 12 12	5			1.5' to 6': SAND, poorly sorted, fine and medium grained, trace of clay, light brown (SP)		2								
		12 14 14	24					3								
39.0	6.0	15 15 15	28					4	1	91	8			7	SP-SC	
37.5	7.5	12 12 14	30			6' to 7.5': SAND, poorly sorted, fine and medium grained, trace of clay, moist, light brown (SP)		5								
36.0	9.0	6 11 11	26			7.5' to 9': SAND, poorly sorted, fine grained, trace of silt, wet , light brown/light gray (SP)		6								
34.5	10.5	2 1 2	22			9' to 10.5': CLAY, stiff, medium plasticity, trace of silt, roots, gray (CL)		7				29	13		CL	
33.0	12.0	2 2 4	3			10.5' to 12': SAND, poorly sorted, fine grained, little clay, trace of silt , light gray/light brown (SP)		8						20		
31.5	13.5	2 3 6	6			12' to 13.5': SAND, coarse grained, some clay, trace of silt, light gray (SC)		9			39			12	SC	
30.0	15.0	5 5 9	9			13.5' to 15': SAND, medium and fine grained, poorly sorted, trace of clay, light gray (SP)		10						12		

Depth to groundwater static at 7.3 feet after 24 hours

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-8

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-8				LOCATION COORDINATES 35.89465°N -77.52°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				11. MANUFACTURER'S DESIGNATION OF DRILL CME-75		12. TOTAL SAMPLES DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER 28.0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				15. DATE BORING 4/17/09		STARTED COMPLETED 4/17/09	
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING 36.0		17. TOTAL CORE RECOVERY FOR BORING N/A	
8. TOTAL DEPTH OF BORING 15.0				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory								REMARKS
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class		
34.5	1.5	2			0' to 1.5': CLAY, stiff, low plasticity, some fine grained sand, trace of silt, roots, reddish brown (CL)		1				34	18	13	CL	Depth to groundwater static at 3.8 feet after 24 hours	
33.0	3.0	5	8		1.5' to 3': SAND, fine grained, some clay, trace of silt, reddish brown (SC)		2					14				
32.5	3.5	6	17		3' to 3.5': SAND, poorly sorted, medium and fine grained, little clay, little organics, reddish brown (SP)		3									
31.5	4.5	6			3.5' to 4.5': SAND, poorly sorted, medium and fine grained, little clay, little organics, light gray (SP)		4	2	77	21		8	SC			
30.0	6.0	20	20		4.5' to 6': SAND, poorly sorted, medium and fine grained, poorly sorted, little silt, trace of clay, light gray (SP)		5									
28.5	7.5	15	45		6' to 7.5': SAND, poorly sorted, fine grained, little silt, trace of clay, light gray (SP)		6			27		16	SM			
27.0	9.0	12	25		7.5' to 9': SAND, fine grained, some silt, trace of clay, moist, dark gray (SM)		7			19		22	SM			
25.5	10.5	2	29		9' to 10.5': SAND, fine grained, some clay, trace of silt, reddish brown (SC)		8									
25.0	11.0	1	5		10.5' to 11': SAND, fine grained, poorly sorted, little clay, trace of silt, reddish brown (SP)		9	0	87	13		25	SC			
21.0	15.0	0	0		11' to 15': SAND, fine grained, poorly sorted, little clay, trace of silt, gray (SP)		10									

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 08-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-9

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-9				LOCATION COORDINATES 35.89446°N -77.52309°W		11. MANUFACTURER'S DESIGNATION OF DRILL CME-75	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				14. ELEVATION GROUND WATER 26.5		15. DATE BORING STARTED 4/17/09 COMPLETED 4/17/09	
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING 38.0		17. TOTAL CORE RECOVERY FOR BORING N/A	
8. TOTAL DEPTH OF BORING 15.0				18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates			

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Sam No.	Laboratory							REMARKS
								Gravel	Sand	Fines	LL	PL	MC	ASTM Class	
36.5	1.5	1 5 7			0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1			19			7	SC	0.0
35.0	3.0	6 7 8	12		1.5' to 3': SAND, poorly sorted, fine and medium grained, trace of clay, light brown (SP)		2								2.5
34.5	3.5	8 9	15		3' to 3.5': SAND, poorly sorted, medium and fine grained, little clay, light brown (SP)		3								
33.5	4.5	11			3.5' to 4.5': SAND, poorly sorted, medium and fine grained, little clay, gray (SP)		4	0	73	27			11	SC	5.0
		6 5 5	20		4.5' to 9': SAND, fine grained, poorly sorted, trace of silt, trace of clay, light brown (SP)		5								7.5
		6 4 3	10				6								
29.0	9.0	2 1	7				7								
		2 2	3		9' to 10.5': SAND, fine grained, some clay, trace of silt, roots, moist, reddish brown (SC)		8								10.0
27.5	10.5	2			10.5' to 11': SAND, some clay, trace of silt, moist, reddish brown (SC)		9								
27.0	11.0	2	4		11' to 12': SAND, some clay, trace of silt, moist, gray (SC)		10						15	SC	
26.0	12.0	4			12' to 15': SAND, poorly sorted, medium grained, trace of clay, wet, reddish brown (SP)										12.5
		3 3 5	6												
		1 4 4	8										19		15.0
23.0	15.0	4													

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Cemented hole with one (1) bag of Portland

Depth to groundwater static at 11.5 feet after 24 hours

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-10

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-10				LOCATION COORDINATES 35.89454°N -77.52275°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				11. MANUFACTURER'S DESIGNATION OF DRILL CME-75		12. TOTAL SAMPLES DISTURBED 10 UNDISTURBED 0	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		14. ELEVATION GROUND WATER 27.0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED				DEG FROM VERTICAL ---		BEARING	
6. THICKNESS OF OVERBURDEN				15. DATE BORING STARTED 4/17/09 COMPLETED 4/17/09		16. ELEVATION TOP OF BORING 40.0	
7. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates	
8. TOTAL DEPTH OF BORING 15.0							

ELEV	DEPTH	Blows/ 0.5 ft	N ₁	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS
									Gravel	Sand	Fines	U	PI	MC	ASTM Class	
38.5	1.5	3				0' to 1.5': SAND, fine grained, some clay, trace of silt, roots, reddish brown (SC)		1			24			6	SC	0.0
37.0	3.0	9	12			1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, reddish brown (SP)		2								2.5
35.5	4.5	7	18			3' to 4.5': SAND, poorly sorted, fine grained, trace of clay, trace of silt, reddish brown (SP)		3	0	70	30			11	SC	
		2	12			4.5' to 7.5': SAND, poorly sorted, fine grained, little silt, trace of clay, light brown (SP)		4								5.0
32.5	7.5	1	2					5								7.5
		1														
		2	3			7.5' to 10.5': SAND, poorly sorted, fine grained, trace of clay, trace of silt, light brown (SP)		6								10.0
29.5	10.5	2						7								
		2	6			10.5' to 12.5': SAND, poorly sorted, fine grained, trace of clay, trace of silt, moist, light brown (SP)		8								12.5
27.5	12.5	3						9								
27.0	13.0	2	7			12.5' to 13': SAND, poorly sorted, fine grained, trace of clay, trace of silt, wet, light brown (SP)										
		3														
		4	5			13' to 15': SAND, poorly sorted, medium grained, little clay, gray (SP)		10						17		Depth to groundwater static at 12.5 feet after 24 hours
25.0	15.0	7														15.0

12

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Boring Designation PD-BP-SS-11

DRILLING LOG		DIVISION South Atlantic		INSTALLATION Wilmington District		SHEET 1 OF 1 SHEETS	
1. PROJECT Princeville Dike, Princeville, NC				9. COORDINATE SYSTEM Geographic		HORIZONTAL VERTICAL	
2. HOLE NUMBER PD-BP-SS-11				LOCATION COORDINATES 35.89477°N -77.51999°W		10. SIZE AND TYPE OF BIT	
3. DRILLING AGENCY				12. TOTAL SAMPLES		DISTURBED 10	
4. NAME OF DRILLER E. Woods				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED		DEG FROM VERTICAL		BEARING ---		14. ELEVATION GROUND WATER 21.5	
6. THICKNESS OF OVERBURDEN				15. DATE BORING		STARTED 4/17/09	
7. DEPTH DRILLED INTO ROCK				16. ELEVATION TOP OF BORING 34.0		COMPLETED 4/17/09	
8. TOTAL DEPTH OF BORING 15.0				17. TOTAL CORE RECOVERY FOR BORING N/A		18. SIGNATURE AND TITLE OF INSPECTOR Stacey Smith/M. Gates	

ELEV	DEPTH	Blows/ 0.5 ft	N ₆₀	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory							REMARKS	
								Gravel	Sand	Fines	LL	PI	MC	ASTM Class		
32.5	1.5	1 3 5			0' to 1.5': SAND, poorly sorted, medium grained, little clay, trace of silt, roots, reddish brown (SP)		1									0.0
31.0	3.0	5 8 11	8		1.5' to 3': SAND, poorly sorted, fine grained, little clay, trace of silt, reddish brown (SP)		2									2.5
26.5	7.5	8 8 9	19			3' to 7.5': SAND, poorly sorted, fine grained, trace of clay, trace of silt, reddish brown (SP)	3	0	88	12			10	SP-SC		5.0
		4 2 1	17	4									7.5			
		1 1 2	3	5												
		2 1 4	3	6												
		2 3 5	5	7												
23.5	10.5	3 4 6	8		7.5' to 10.5': SAND, fine grained, some clay, trace of silt, reddish brown (SC)	8	0	84	16			12	SC		10.0	
22.0	12.0	2 6 7	10			10.5' to 12': SAND, poorly sorted, medium grained, little clay, moist, light brown (SC)	9									12.5
19.0	15.0	4 5 6	13				12' to 15': SAND, poorly sorted, medium grained, trace of clay, wet, light gray (SC)	10						20		
Depth to groundwater static at 12.0 feet after 24 hours																

Depth to groundwater static at 12.0 feet after 24 hours

Cemented hole with one (1) bag of Portland

ACE 1836-A (DRILLING LOG) 09-177 PRINCEVILLE DIKE.GPJ ACE MVD WITH RAPID CPT 06-09-08.GDT 11/10/09

Attachment 3

Laboratory Data

SINCE



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FROEHLING & ROBERTSON, INC.

INSPECTION ENGINEERS • CHEMISTS • BACTERIOLOGISTS

CABLE ADDRESS—"FROEHLING"

Richmond, Virginia

November 9, 1965

MAIN OFFICE AND LABORATORIES

814 WEST CARY STREET

RICHMOND, VIRGINIA

PHONE 644-3025

BRANCH LABORATORIES

NORFOLK, CHARLOTTE, RALEIGH

WASHINGTON, BALTIMORE

GREENVILLE, ROANOKE, FAYETTEVILLE

Record No: N-1435-10
 Report of: Soil Tests
 Made for: District Engineer, Corps of Engineers, P. O. Box 1890, Wilmington,
 North Carolina Attn: Mr. C. J. Frazelle
 Project: Soil Borings of Borrow Area, Tarboro, North Carolina

0-0-0

Boring No.	FR-22	FR-22	FR-22	FR-23
Sample No.	1 & 2	5 & 6	7	3 & 4
Passing 3/8" Sieve	100.0	100.0	100.0	100.0
Passing No. 4	100.0	100.0	100.0	98.3
Passing No. 10	100.0	100.0	100.0	93.3
Passing No. 40	99.7	99.9	100.0	27.3
Passing No. 60	82.7	90.8	95.1	7.7
Passing No. 100	30.9	42.3	51.2	3.6
Passing No. 200	9.9	16.2	17.8	2.2

Boring No.	FR-24	FR-24	FR-25	FR-25
Sample No.	3	4 & 5	1 & 2	3 & 4
Passing 3/8" Sieve	100.0	100.0	100.0	100.0
Passing No. 4	100.0	100.0	100.0	100.0
Passing No. 10	97.8	97.6	99.8	99.7
Passing No. 40	33.4	38.8	91.1	85.4
Passing No. 60	9.4	16.6	70.9	62.2
Passing No. 100	4.3	7.7	42.3	23.4
Passing No. 200	3.7	4.5	16.8	6.4

Respectfully,

FROEHLING & ROBERTSON, INC.

4cc Corps of Engineers
 1cc F&R, Raleigh



FROEHLING & ROBERTSON, INC.

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Page 2

Boring No.	FR-25	FR-25
Sample No.	5	6 & 7
Passing 3/8" Sieve	100.0	100.0
Passing No. 4	100.0	100.0
Passing No. 10	97.2	99.5
Passing No. 40	58.2	67.3
Passing No. 60	22.1	35.7
Passing No. 100	10.3	15.7
Passing No. 200	7.6	5.9



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INSPECTION ENGINEERS • CHEMISTS • BACTERIOLOGISTS

CABLE ADDRESS—"FROEHLING"

Richmond, Virginia

November 3, 1965

MAIN OFFICE AND LABORATORIES

814 WEST CARY STREET
RICHMOND, VIRGINIA
PHONE 644-3025

BRANCH LABORATORIES

NORFOLK, CHARLOTTE, RALEIGH
WASHINGTON, BALTIMORE
GREENVILLE, ROANOKE, FAYETTEVILLE

Record No: N-1435-11

Report of: Soil Tests

Made for: District Engineer, Corps of Engineers, P. O. Box 1890 Wilmington,
North Carolina Attn: Mr. C. J. Frazelle

Project: Soil Borings of Borrow Area, Tarboro, North Carolina

0-0-0

Boring No.	FR-7	*FR-7	FR-7	FR-8	FR-8
Sample No.	162	3	5,667	1	364
Passing 3/8" Sieve					
Passing No. 4		100	100		100
Passing No. 10	100	99.0	98.1	100.0	99.6
Passing No. 40	91.1	72.1	41.1	95.6	83.4
Passing No. 60	74.4	60.4	25.4	64.5	33.1
Passing No. 100	39.7	29.5	11.7	22.8	9.0
Passing No. 200	18.1	16.6	5.0	8.3	6.0
Liquid Limit		22.2		18.6	
Plasticity Index		N. P.		N. P.	
Boring No.	FR-9	FR-10	FR-10	*FR-11	*FR-11
Sample No.	2,364	162	465	1	2
Passing 3/8" Sieve	100.0		100.0		
Passing No. 4	99.6		97.7	100	100
Passing No. 10	97.4	100.0	95.7	99.1	97.2
Passing No. 40	35.2	82.1	51.5	74.4	51.6
Passing No. 60	16.1	66.5	27.6	52.5	26.0
Passing No. 100	6.2	37.9	9.6	33.2	11.9
Passing No. 200	3.3	21.1	3.5	26.3	9.3
Liquid Limit		18.0		18.6	20.6
Plasticity Index		N. P.		N. P.	N. P.



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Page 2

Boring No.	FR-11	*FR-20	*FR-20	FR-20	FR-21
Sample No.	4,5,6&7	1	3	4,5,6&6	2,3&4
Passing 3/8" Sieve				100.0	
Passing No. 4	100.0			99.7	
Passing No. 10	94.7		100.0	99.6	100.0
Passing No. 40	38.2	100.0	99.7	99.4	99.8
Passing No. 60	15.6	98.7	94.6	95.3	85.3
Passing No. 100	6.7	90.0	60.7	49.4	34.6
Passing No. 200	3.8	71.2	33.4	20.4	11.8
Liquid Limit		29.2	23.9		
Plasticity Index		16.5	8.4		

* See attached curves for complete mechanical analysis.

Respectfully,

FROEHLING & ROBERTSON, INC.

4cc Corps of Engineers
1cc F&R, Raleigh
/jg

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

PROJECT

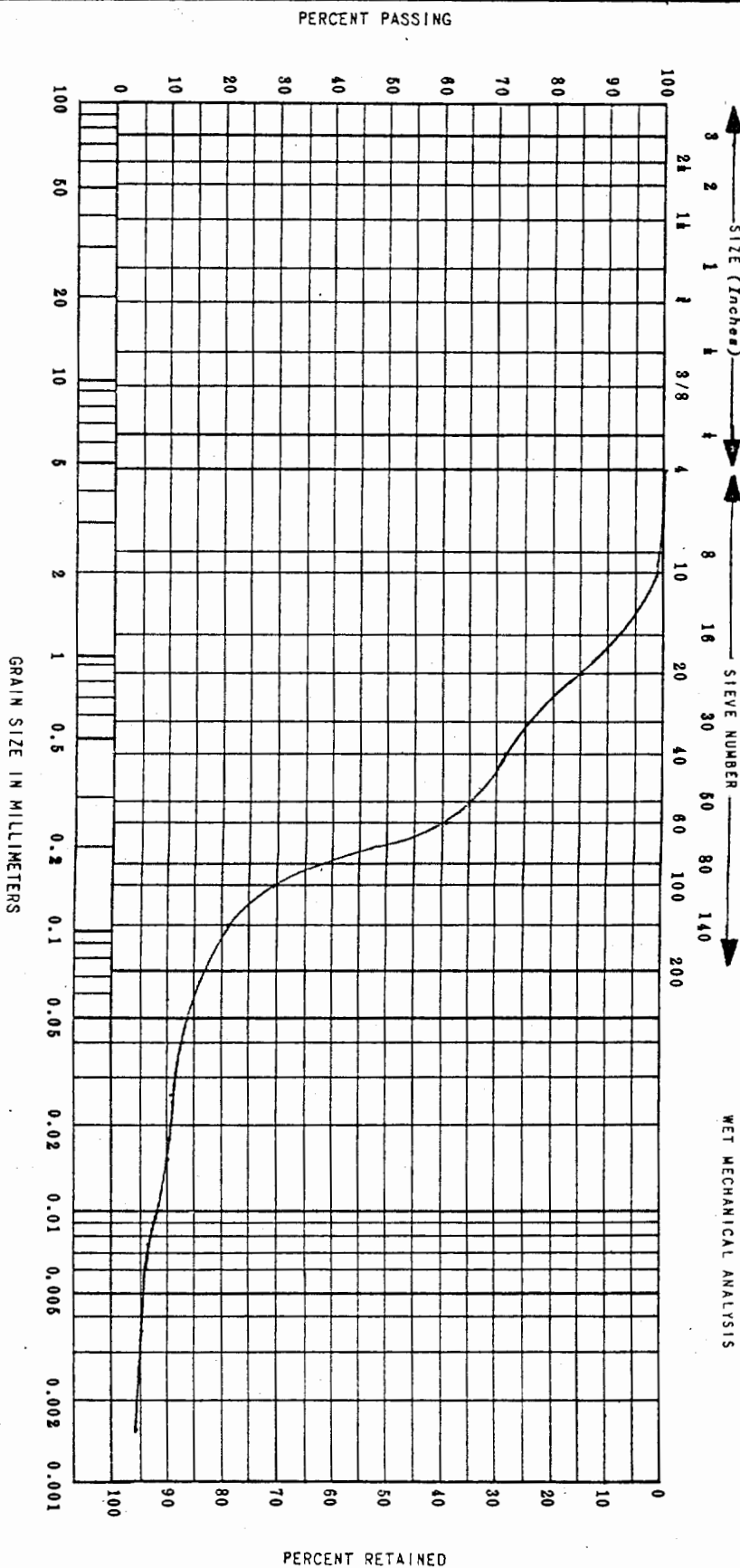
Soil Borings of Barron Area - Tarboro N.C.

DATE

3 Nov 65

US STANDARD SIEVES

WET MECHANICAL ANALYSIS



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	W _L	W _P	I _P	CLASSIFICATION	REMARKS
ER-7	3		22.2		N.P.		Depth 3.0' - 4.5'
TECHNICIAN (Signature)							
PLOTTED BY (Signature)						CHECKED BY (Signature)	

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

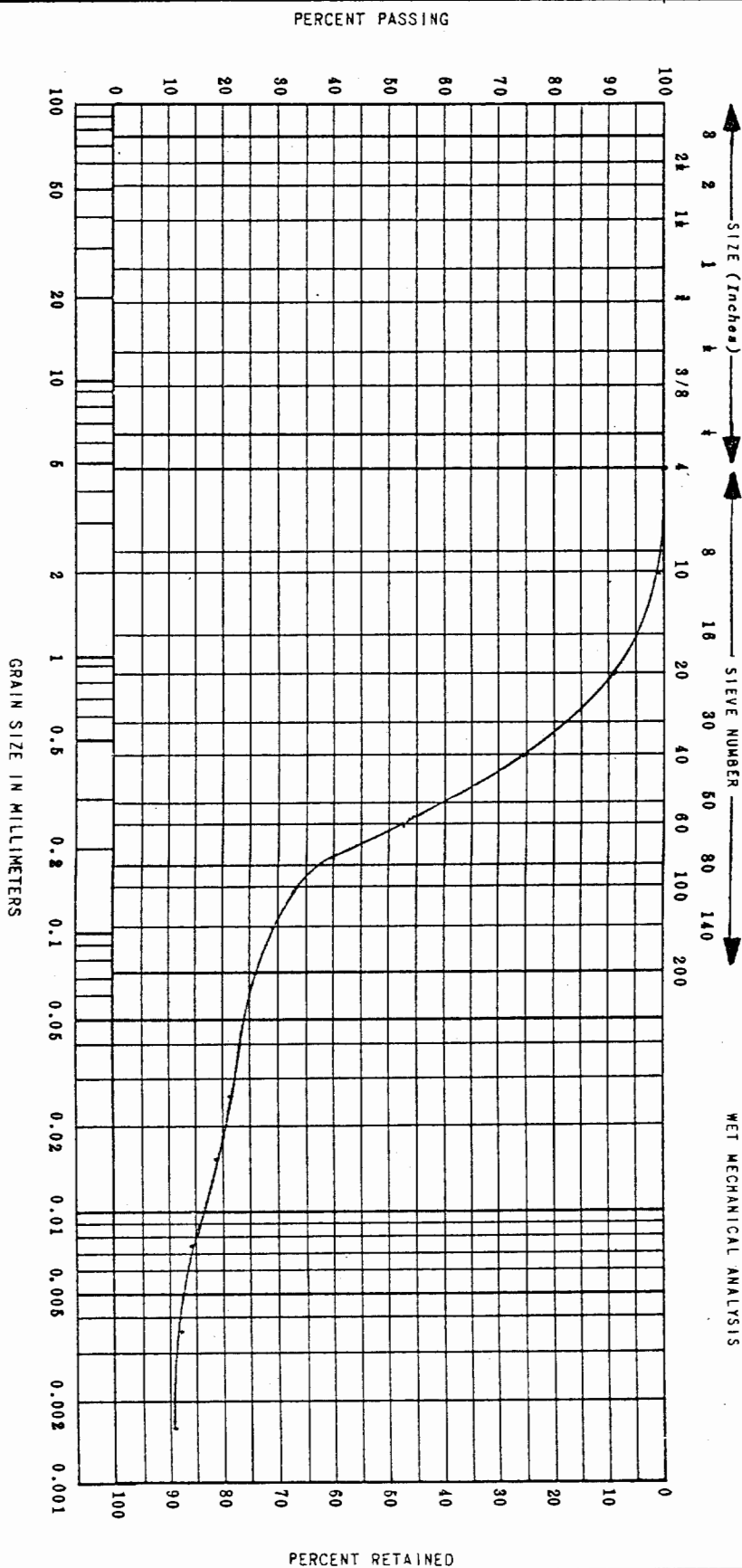
PROJECT

Soil Borings of Barrow Area - Fairbanks, AK

DATE
3 Nov 65

US STANDARD SIEVES

WET MECHANICAL ANALYSIS



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	W _L	W _P	I _P	CLASSIFICATION	REMARKS
FR-11	1		18.6		N.P.		0-1.5'
TECHNICIAN (Signature)		PLOTTED BY (Signature)		CHECKED BY (Signature)			

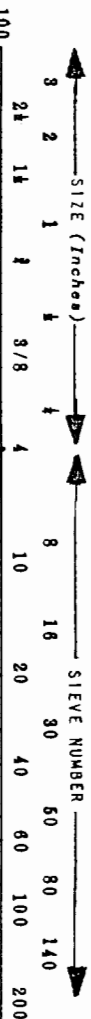
GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

PROJECT

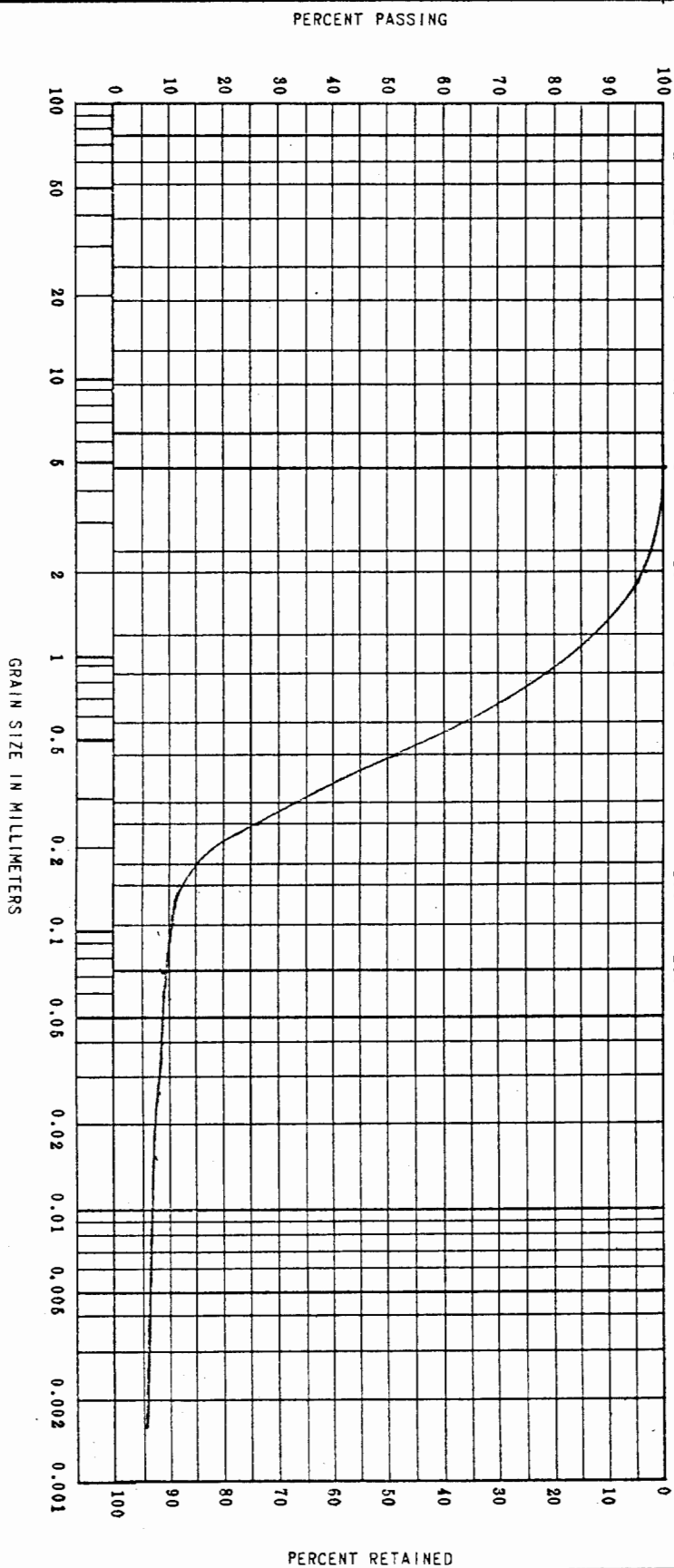
Soil Borings of Barron Area - Tallapoosa Co.

DATE
3 Nov 65

US STANDARD SIEVES



WET MECHANICAL ANALYSIS



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	W _L	W _P	I _P	CLASSIFICATION	REMARKS
ER-11	2		20.6		N.P.		Depth 1.5'-3.0'
TECHNICIAN (Signature)		PLOTTED BY (Signature)		CHECKED BY (Signature)			

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

PROJECT

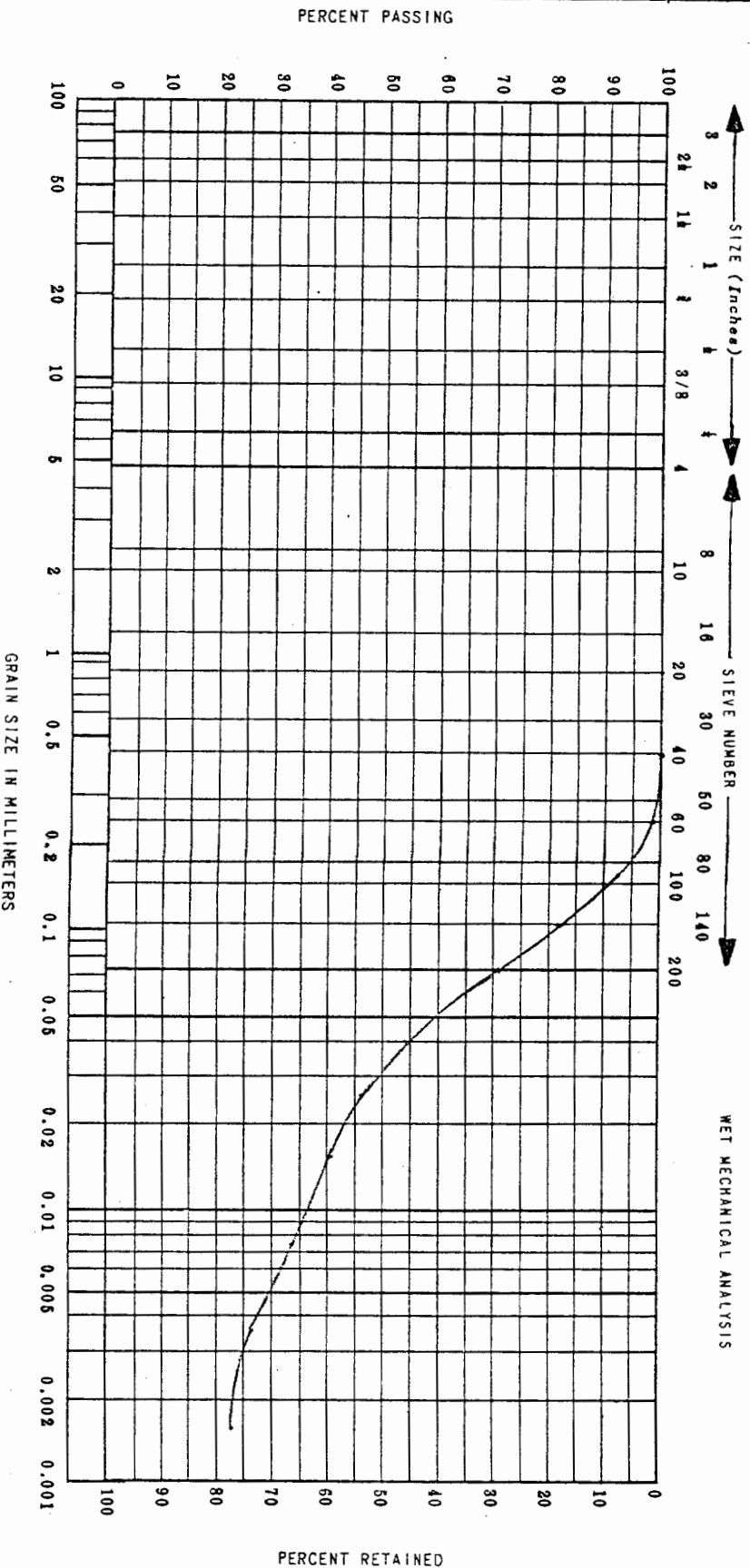
Sail Borings of Barron Area - Tohara N.C.

DATE

3 Nov 65

US STANDARD SIEVES

WET MECHANICAL ANALYSIS



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	W _L	W _P	I _P	CLASSIFICATION	REMARKS
FR-20	1		29.2	12.7	16.5		Depth 0 - 1.5'
TECHNICIAN (Signature)		PLOTTED BY (Signature)			CHECKED BY (Signature)		

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

PROJECT

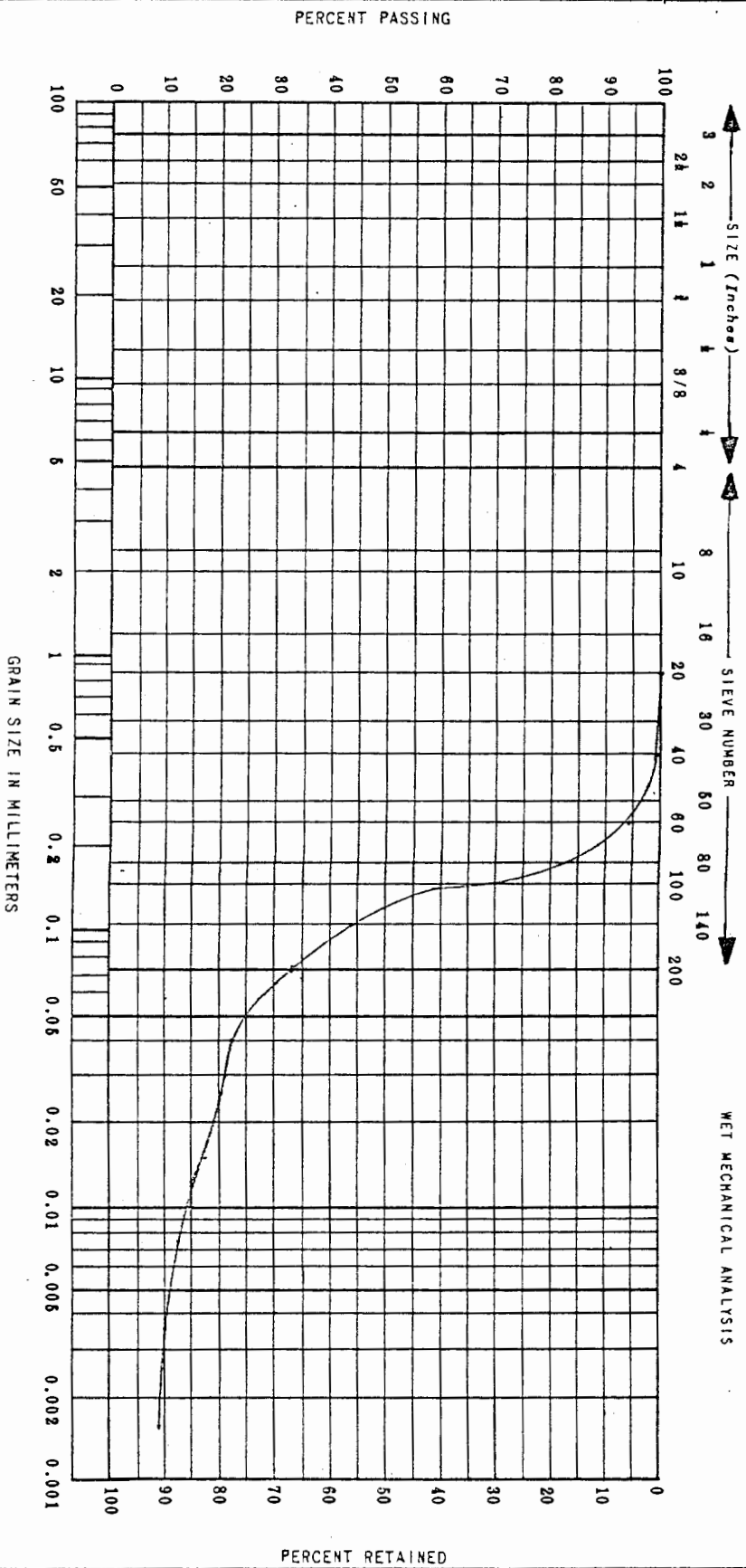
Soil Borings of Barrow - Izbera AC

DATE

3 Nov 65

US STANDARD SIEVES

WET MECHANICAL ANALYSIS



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL MOISTURE	W _L	W _P	I _P	CLASSIFICATION	REMARKS
FR-20	3		23.9	15.5	8.4		Depth 30'-4.5'
TECHNICIAN (Signature)		PLOTTED BY (Signature)		CHECKED BY (Signature)			

SINCE



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P. O. Box 64276, Fayetteville, North Carolina 28306
 Phone: (910) 323-9832 Fax: (910) 323-5455

February 22, 2000

Mr. Ben Lanier
 Lanier Construction Company, Inc.
 Route 2, Box 252-A-A
 Snow Hill, North Carolina 28580

RE: Laboratory Summary
 Princeville Dike Repairs
 F&R Project Number A64-207

Gentlemen:

As requested, Froehling and Robertson, Inc. (F&R) has completed the laboratory testing for the acceptance samples for above referenced project site. The following table presents a summary of the laboratory results.

Test Procedure	Sample 1	Sample 2	Sample 3	Sample 4
Particle Size Analysis (ASTM-422)				
% passing #4	100	100	100	99
% passing #10	100	98	97	94
% passing #40	76	77	74	53
% passing #100	72	58	41	39
% passing #200	63	50	33	34
Standard Proctor (ASTM-D698)				
Maximum dry density	113.8	109.6	115.6	112.6
Optimum Moisture Content	14.8	16.5	13.3	15.1
Atterberg Limits (ASTM-D4318)				
Liquid Limit	25	27	31	47
Plastic Limit	15	11	17	23
Plastic Index	10	16	14	14
Natural Moisture Content	19.2	15.4	19.7	16.5
USCS Classification	CL	SC	SC	SC

If you have any questions regarding this information, or if additional information is required, please do not hesitate to contact us.

Respectfully submitted,

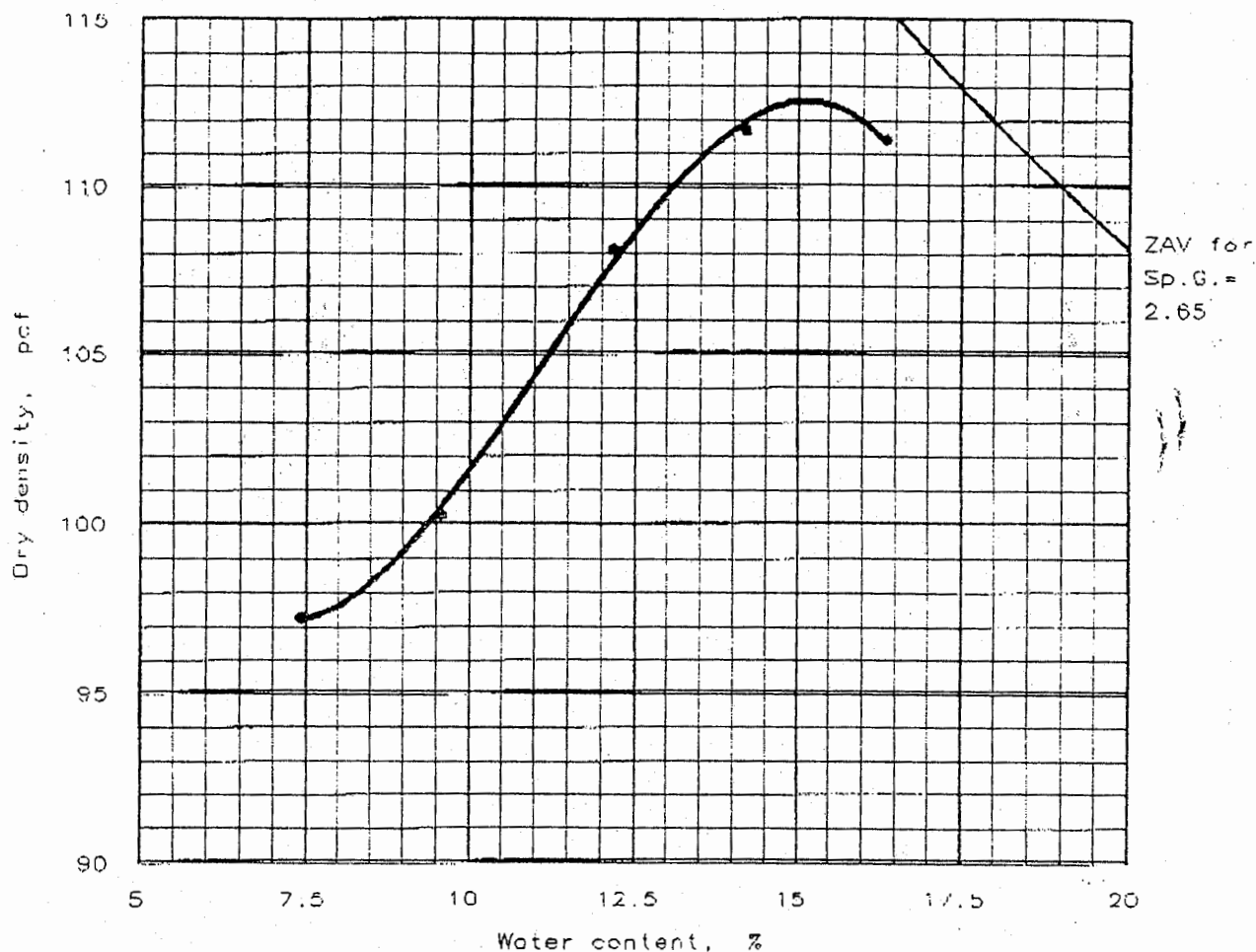
Froehling and Robertson, Inc.

Kurt A. Miller, P.E.
 Fayetteville Branch Manager

HEADQUARTERS: 3015 DUMBARTON ROAD • BOX 27524 • RICHMOND, VA 23261-7524
 TELEPHONE (804) 264-2701 • FAX (804) 264-1202

BRANCHES: ASHEVILLE, NC • ATLANTA, GA • BALTIMORE, MD • CHARLOTTE, NC
 CHESAPEAKE, VA • CROZET, VA • FAYETTEVILLE, NC • FREDERICKSBURG, VA
 GREENSBORO, NC • HARRISBURG, PA • RICHMOND, VA • WASHINGTON, DC

MOISTURE-DENSITY RELATIONSHIP TEST

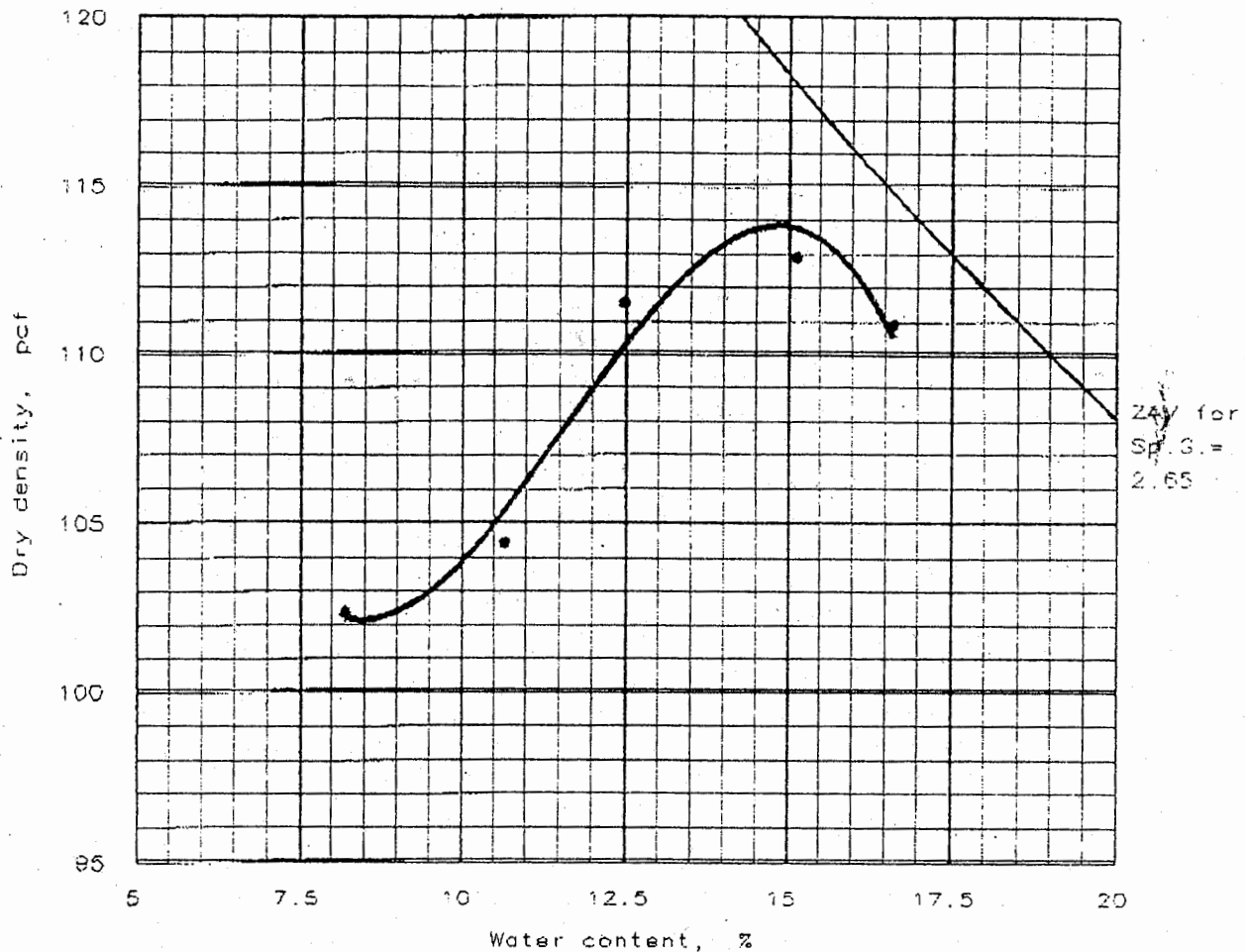


Test specification: ASTM D 698-91 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
INA	SC		16.5 %	INA	47	14	1.0 %	33.8 %

TEST RESULTS				MATERIAL DESCRIPTION			
Maximum dry density = 112.6 pcf Optimum moisture = 15.1 %				Brown/Tan clayey SAND			
Project No.: A64-207 / 73037 Project: Princeville Dike Location: Wake Quarry North Date: 02/24/00				Remarks: Lonier Construction Sample No. 4			
MOISTURE-DENSITY RELATIONSHIP TEST FROEHLING & ROBERTSON, INC.				Fig. No. 856E			

MOISTURE-DENSITY RELATIONSHIP TEST

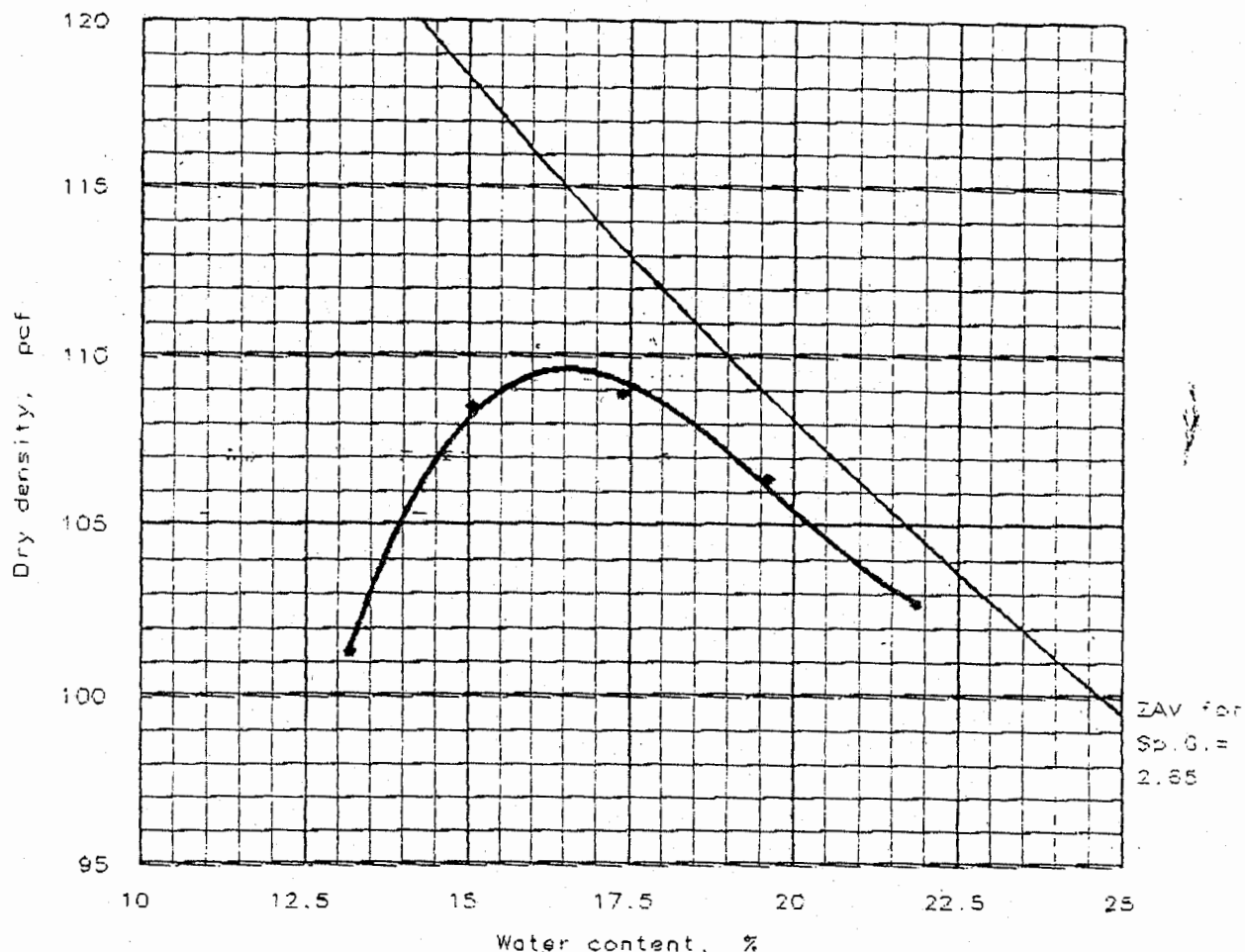


Test specification: ASTM D 698-91 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
INA	CL		19.2 %	INA	25	10	0.00 %	62.6 %

TEST RESULTS		MATERIAL DESCRIPTION	
Maximum dry density = 113.8 pcf Optimum moisture = 14.8 %		Brown silt to medium sandy clay	
Project No.: A64-207 / 73030 Project: Princeville Dike Location: Princeville, North Carolina Date: 02/18/00		Remarks: Lonier Sample No. 1 Cobb Form, Hwy 43	
MOISTURE-DENSITY RELATIONSHIP TEST FROEHLING & ROBERTSON, INC.		Fig. No. 844E	

MOISTURE-DENSITY RELATIONSHIP TEST

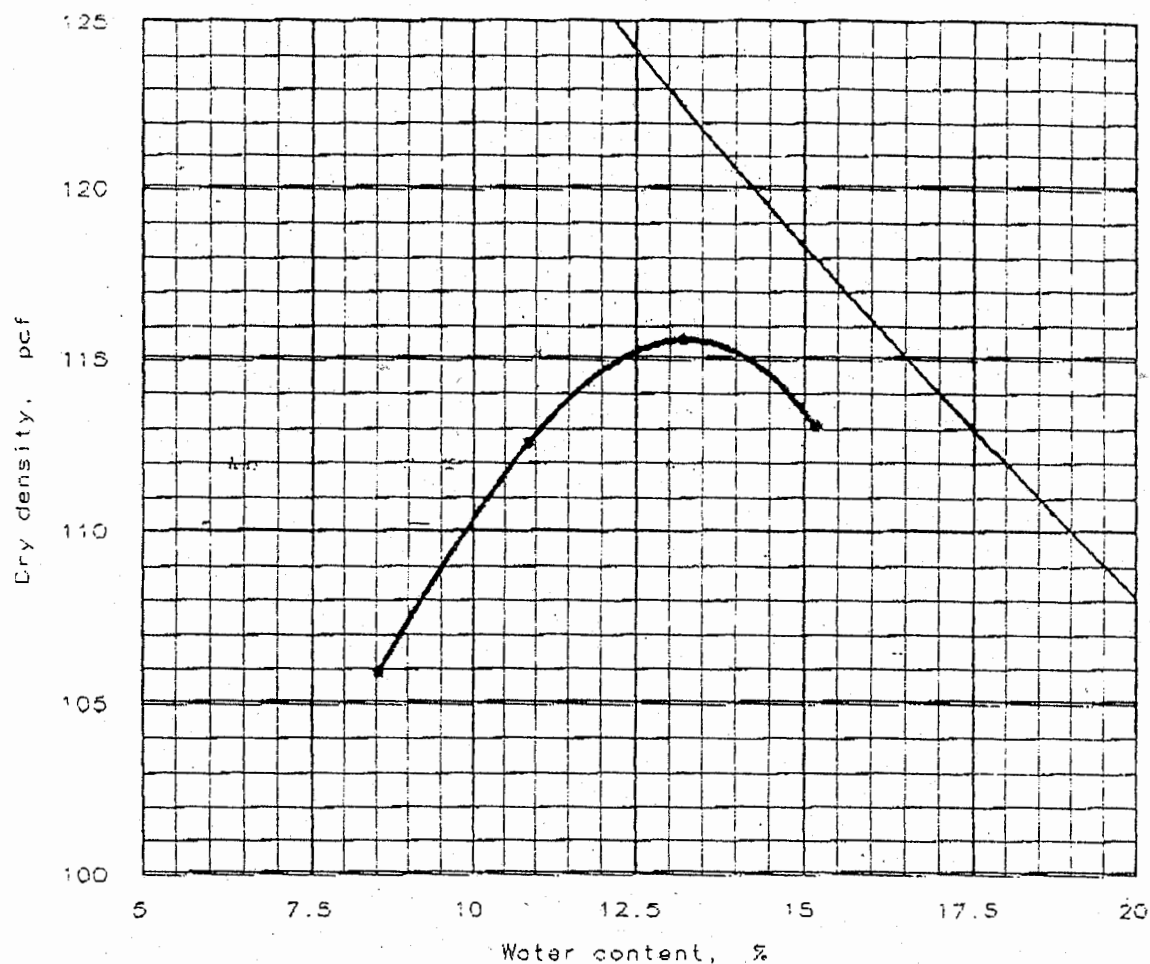


Test specification: ASTM D 698-91 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
INA	SC	ASMT	15.4 %	INA	27	16		49.9 %

TEST RESULTS		MATERIAL DESCRIPTION	
Maximum dry-density = 109.6 pcf Optimum moisture = 16.5 %		Gray/Tan Clayey SAND	
Project No.: A64-207 / 73035 Project: Princeville Dike Location: Wake Quarry South Date: 02/22/00		Remarks: Lonier Sample No. 2	
MOISTURE-DENSITY RELATIONSHIP TEST FROEHLING & ROBERTSON, INC.		Fig. No. 846E	

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Method A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	FI	% > No. 4	% < No. 200
	USCS	AASHTO						
INA	SC	AS	19.7 %	INA	31	14		32.9 %

TEST RESULTS		MATERIAL DESCRIPTION	
Maximum dry density = 115.6 pcf Optimum moisture = 13.3 %		Brown/Tan Clayey fine to medium SAND	
Project No.: A64-207 / 73036 Project: Princeville Dike Location: Wake Quarry Center Date: 02/22/00		Remarks: Lonier Sample No. 3	
MOISTURE-DENSITY RELATIONSHIP TEST FROEHLING & ROBERTSON, INC.		Fig. No. 848E	



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Record No.: A64-207

Made for: Lanier

Project: Princeville Dyke Repair

Date: 03/29/00

Type of Soil

A = cohesive

B = cohesionless

C = ABC Stone

Test Method

NG = Nuclear Gauge

SC = Sand Cone

DT = Drive Tube

Remarks:

Above test results represent:	Spot Checks	X	Full Time Fill Monitoring
-------------------------------	-------------	---	---------------------------

Maximum density in accordance with:

ASTM D1557	_____	AASHTO T180
ASTM D698		AASHTO T99

Testing Technician: Jerry Mesa

FROEHLING & ROBERTSON, INC.

HEADQUARTERS: 3015 DUMBARTON ROAD • BOX 27524 • RICHMOND, VA 23261-7524
TELEPHONE (804) 264-2701 • FAX (804) 264-1202

BRANCHES: ASHEVILLE, NC • ATLANTA, GA • BALTIMORE, MD • CHARLOTTE, NC
CHESAPEAKE, VA • CROZET, VA • FAYETTEVILLE, NC • FREDERICKSBURG, VA
GREENVILLE, SC • RALEIGH, NC • ROANOKE, VA • STERLING, VA • WINSTON-SALEM, NC

SINCE



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APR 14 2000

REPORT OF FIELD DENSITY TESTS

Record No.: A64-207

Made for: Lanier

Project: Princeville Dyke Repair

Date: 03/29/00

Type of Soil

A = cohesive

B = cohesionless

C = ABC Stone

Test Method

NG = Nuclear Guage

SC = Sand Cone

DT = Drive Tube

Test No.	Dry Density	Field (%) Moisture	Opt. (%) Moist.	Maximum Density (pcf)	Proctor Curve(s)	% Comp.	% Comp. Required	Type of Soil	Test Method
1	112.8	9.4	12.7	118.2	848E	95.4	95.0	SC	SC
2	114.1	9.8	12.6	118.9	848E	96.0	95.0	SC	SC
3	113.7	10.5	12.8	117.4	848E	97.0	95.0	SC	SC
4	113.9	11.0	13.1	116.1	848E	98.0	95.0	SC	SC
Test No.:	Locations: (Drawing Attached? NO							Elevation	
1	100' west of east end foundation							1st lift	
2	200' west of east end foundation							1st lift	
3	300' west of east end foundation							1st lift	
4	100' west of east mount							1st lift	

Remarks:

Above test results represent: Spot Checks X Full Time Fill Monitoring _____

Maximum density in accordance with: ASTM D1557 _____ AASHTO T180 _____
 ASTM D698 _____ AASHTO T99 _____

Testing Technician: Jerry Mesa

FROEHLING & ROBERTSON, INC.

HEADQUARTERS: 3015 DUMBARTON ROAD • BOX 27524 • RICHMOND, VA 23261-7524
 TELEPHONE (804) 264-2701 • FAX (804) 264-1202

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 CHESAPEAKE, VA • CROZET, VA • FAYETTEVILLE, NC • FREDERICKSBURG, VA
 GREENVILLE, SC • RALEIGH, NC • ROANOKE, VA • STERLING, VA • WINSTON-SALEM, NC

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REPORT OF FIELD DENSITY TESTS

Record No.: A64-207Made for: LanierProject: Princeville Dyke RepairDate: 04/03/00

Type of Soil

A = cohesive

B = cohesionless

C = ABC Stone

Test Method

NG = Nuclear Guage

SC = Sand Cone

DT = Drive Tube

Test No.	Dry Density	Field (%) Moisture	Opt. (%) Moist.	Maximum Density (pcf)	Proctor Curve(s)	% Comp.	% Comp. Required	Type of Soil	Test Method
1	107.2	13.0	14.2	109.1	848E	98.3	95.0	SC	SC
2	118.1	10.6	12.3	122.5	848E	96.4	95.0	SC	SC
3	111.8	16.0	14.9	113.3	844E	98.7	95.0	CL	SC
4	110.0	13.7	15.2	111.8	844E	98.4	95.0	CL	SC
Test No.:	Locations: (Drawing Attached? NO							Elevation	
1	Station 32+80							30" above FSG	
2	Station 33+50							30" above FSG	
3	Station 34+50							30" above FSG	
4	Station 41							30" above FSG	

Remarks: _____

Above test results represent: Spot Checks X Full Time Fill Monitoring _____

Maximum density in accordance with: ASTM D1557 _____ AASHTO T180 _____
 ASTM D698 _____ AASHTO T99 _____

Testing Technician: Jerry Mesa

FROEHLING & ROBERTSON, INC.

HEADQUARTERS: 3015 DUMBARTON ROAD • BOX 27524 • RICHMOND, VA 23261-7524
 TELEPHONE (804) 264-2701 • FAX (804) 264-1202

BRANCHES: ASHEVILLE, NC • ATLANTA, GA • BALTIMORE, MD • CHARLOTTE, NC
 CHESAPEAKE, VA • CROZET, VA • FAYETTEVILLE, NC • FREDERICKSBURG, VA
 GREENVILLE, SC • RALEIGH, NC • ROANOKE, VA • STERLING, VA • WINSTON-SALEM, NC

SINCE



1881

FROEHLING & ROBERTSON, INC.GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES**"OVER ONE HUNDRED YEARS OF SERVICE"****REPORT OF FIELD DENSITY TESTS**Record No.: **A64-207**Made for: **Lanier**Project: **Princeville Dyke Repair**Date: **04/04/00**

Type of Soil

A = cohesive

B = cohesionless

C = ABC Stone

Test Method

NG = Nuclear Guage

SC = Sand Cone

DT = Drive Tube

Test No.	Dry Density	Field (%) Moisture	Opt. (%) Moist	Maximum Density (pcf)	Proctor Curve(s)	% Comp.	% Comp. Required	Type of Soil	Test Method
1	107.0	16.6	17.2	108.2	62K	98.9	95.0	SC	SC
2	103.7	18.2	17.4	104.0	62K	99.7	95.0	SC	SC
3	108.2	15.6	17.0	109.5	62K	98.8	95.0	SC	SC
4	107.3	15.8	17.2	108.5	62K	98.9	95.0	SC	SC
5	105.8	17.0	17.4	106.7	62K	99.2	95.0	SC	SC
Test No.:	Locations: (Drawing Attached? NO)							Elevation	
1	Station 31							40" above FSG	
2	Station 32							40" above FSG	
3	Station 33							40" above FSG	
4	Station 34							40" above FSG	
5	Station 41							40" above FSG	

Remarks:

Above test results represent: Spot Checks X Full Time Fill Monitoring

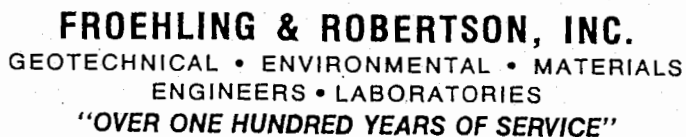
Maximum density in accordance with: ASTM D1557 AASHTO T180
ASTM D698 AASHTO T99

Testing Technician: Jerry Mesa

FROEHLING & ROBERTSON, INC.

HEADQUARTERS: 3015 DUMBARTON ROAD • BOX 27524 • RICHMOND, VA 23261-7524
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GREENVILLE, SC • RALEIGH, NC • ROANOKE, VA • STERLING, VA • WINSTON-SALEM, NC

TITAN ATLANTIC GROUP

111-C W. FIRE TOWER RD
WINTERVILLE, N.C. 28590
TELEPHONE (252) 353-1600

CLIENT: US Army Corps of Engineers
PROJECT: Princeville Dike Repair
WEATHER: Partly cloudy and warm
TITAN JOB NO.: 0284-80

Date: 4/18/00

Personnel: John Henry Martin

As requested by Mr. Jim Mullins, representing US Army Corps of Engineers, a representative of Titan Atlantic Group, Inc. was present on the project site for field density testing services.

Four field density tests were performed in structural fill soils installed for the dike repair in the vicinity of Riverside Trailer Park. The tests were performed at approximately 3.5 and 5.5 feet below the final soil subgrade elevation and at the approximate final soil subgrade elevation.

Field density test results were computed to range from 93 to 100 percent of the maximum dry density, as determined by ASTM D-698 (minimum required compaction: 90 percent).

In addition, one field density test was performed in fill soils installed as "cap" material on the existing dike west of the highway 258 bridge. The test was performed at the approximate final soil subgrade elevation.

The field density test result was computed to be 100 percent of the maximum dry density as determined by ASTM D-698 (minimum required compaction: 90 percent).

Two bulk samples of off site borrow soils (one from Rocky Mount and one from Tarboro/Princeville) were obtained from the test locations. The samples were returned to our laboratory where they were prepared for standard Proctor compaction testing, Atterburge limits testing and grain size analyses. These test results are attached.

Mr. Jim Mullins was informed of the test results by written transmittal.

Respectfully Submitted
TITAN ATLANTIC

Bob Huel

TITAN ATLANTIC GROUP, INC.**Princeville Dike Repair**

Prepared for: US Army Corps of Engineers
 PO Box 100
 Fairfield, NC 27826

Project No.: 0284-80
 Date: April 26, 2000

Attn: Mr. Jim Mullins

SOILS USED IN FILL

Curve No.	Max Dry Density	Optimum Moisture	Test Method
1	116.0	13.2	ASTM D-698
2	115.3	12.8	ASTM D-698

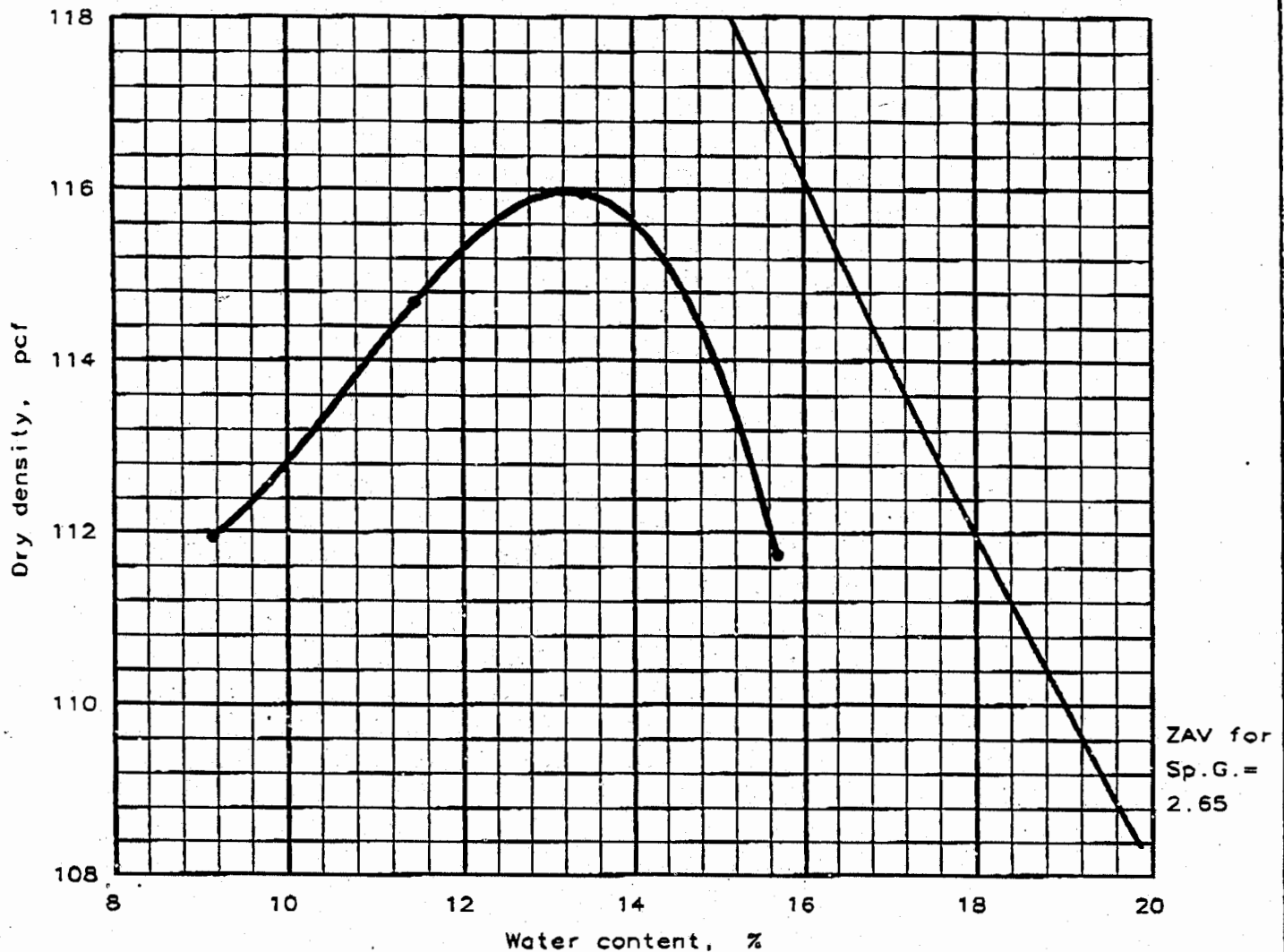
TEST RESULTS

Test No.	Date	Location Location (cont'd) Elevation	Wet Density PCF	Moisture Content %	Dry Density PCF	Max Dry Density PCF	Reqd. Comp.	Test Comp.
1	04/18/00	Top of Dike; Station 34+15 Grade	136.5	17.0	116.7	115.3	90	101.0
2	04/18/00	Top of Dike; Station 36+35 Grade	135.6	17.2	115.7	115.3	90	100.0
3	04/18/00	South side of Dike; Station 37+35 3.5	126.2	18.3	106.7	115.3	90	93.0
4	04/18/00	North side of Dike; Station 35+15 5.5	128.0	17.2	109.2	115.3	90	95.0
5	04/18/00	Top of Dike; Station 62+85 Grade	137.7	12.1	122.8	116.0	90	106.0

Remarks:
 Copies to:

Bob Heel

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	SC	A-2-4			27	10	0.0 %	33.7 %

TEST RESULTS

Maximum dry density = 116.0 pcf
Optimum moisture = 13.2 %

MATERIAL DESCRIPTION

ORA BRN SILTY CLAYEY
FINE TO MEDIUM SAND

Project No.: 0284-80

Project: PRINCEVILLE DIKE REPAIR

Location: PRINCEVILLE, NORTH CAROLINA

CLIENT: U. S. ARMY CORPS OF ENGINEERS

Date: APRIL 22, 2000

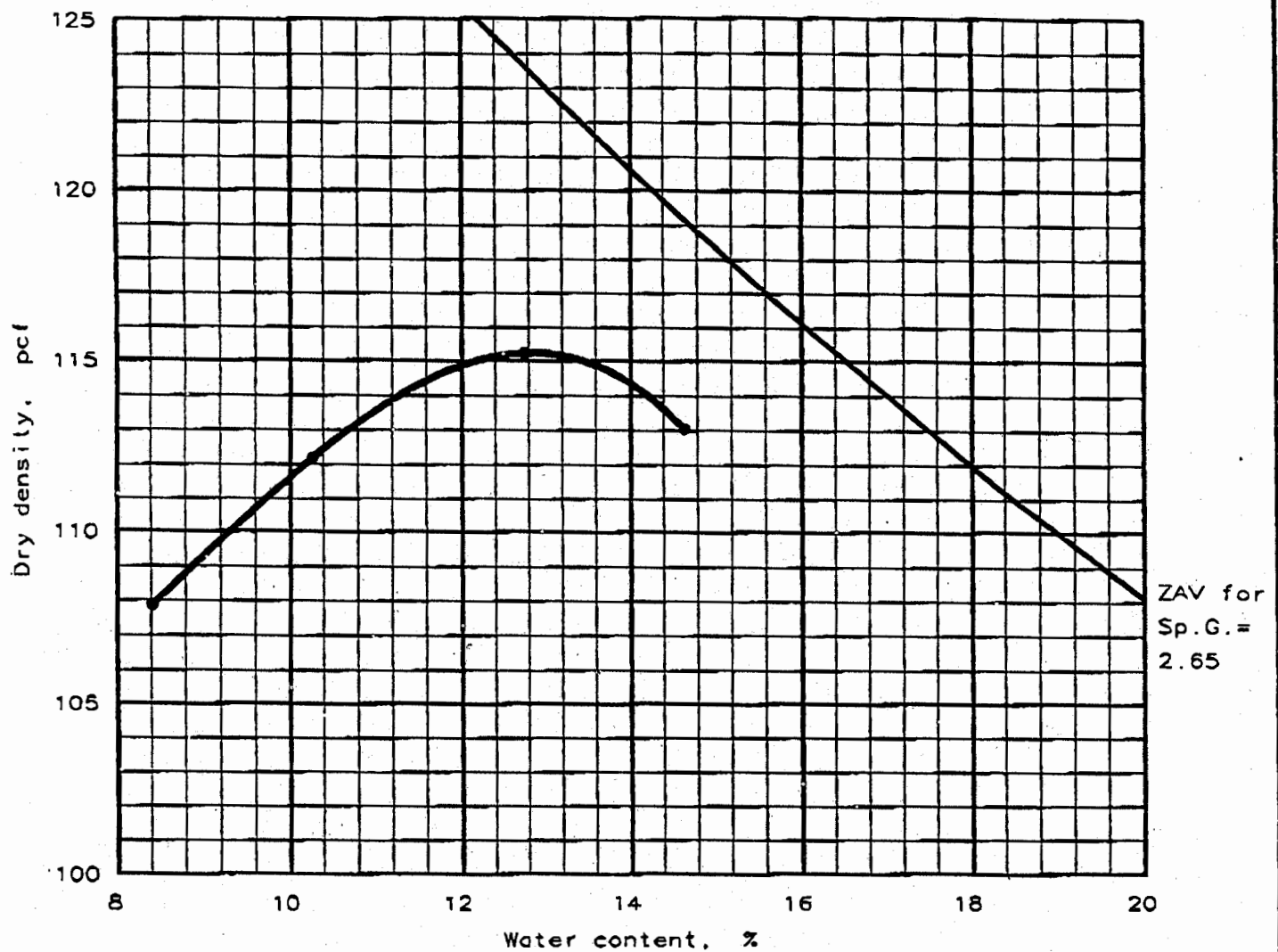
Remarks:

PROPOSED EMBANKMENT FILL
SOILS FOR PROJECT; FROM
ROCKY MOUNT, NC

MOISTURE-DENSITY RELATIONSHIP TEST
TITAN ATLANTIC GROUP, INC.

Fig. No. 0284-1

MOISTURE-DENSITY RELATIONSHIP TEST

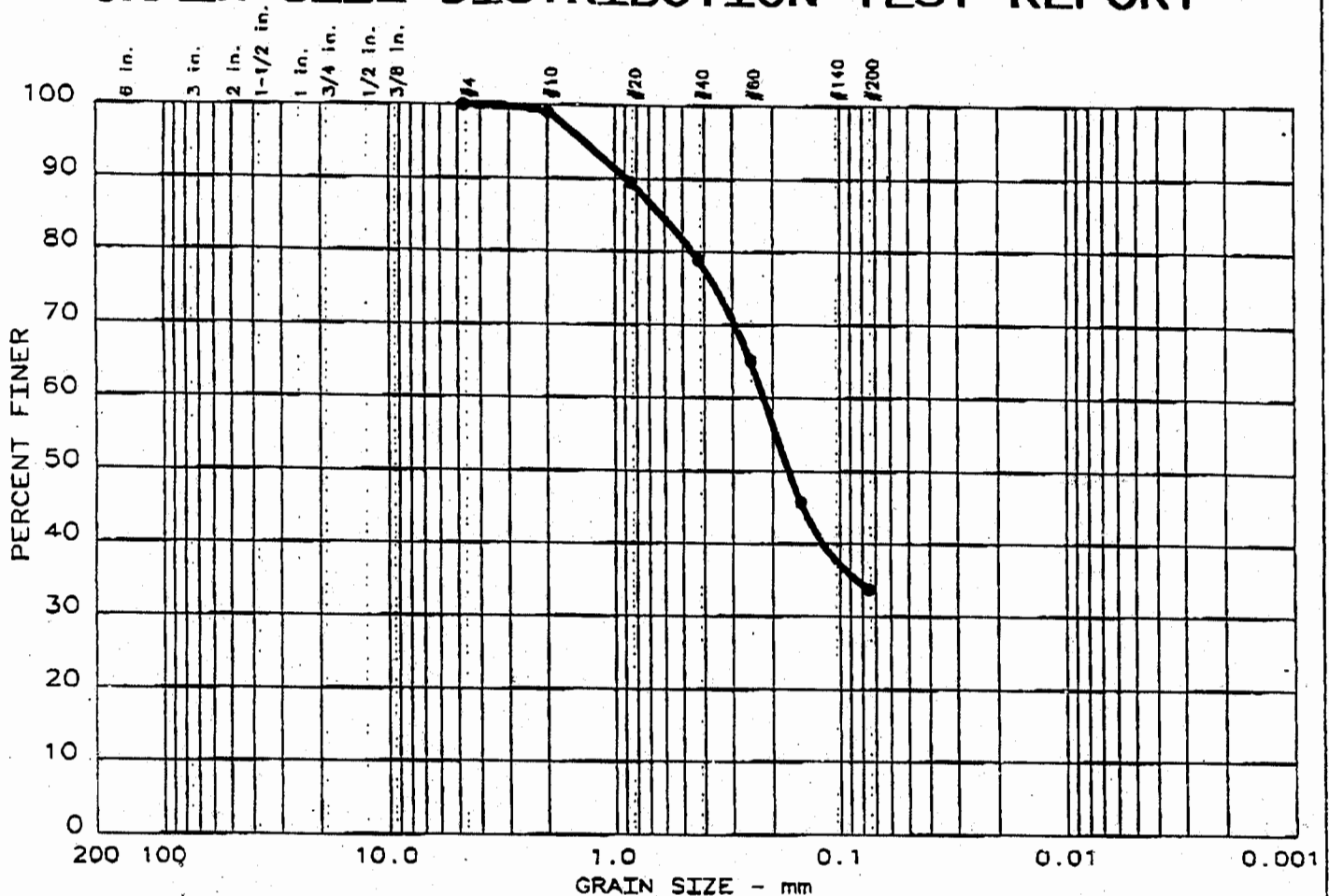


Test specification: ASTM D 698-91 Procedure A, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						
	SC	A-6			29	11	0.0 %	41.2 %

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.3 pcf Optimum moisture = 12.8 %	YEL BRM SILTY CLAYEY FINE TO MEDIUM SAND
Project No.: 0284-80 Project: PRINCEVILLE DIKE REPAIR Location: PRINCEVILLE, NORTH CAROLINA CLIENT: U. S. ARMY CORPS OF ENGINEERS Date: APRIL 22, 2000	Remarks: PROPOSED EMBANKMENT FILL SOILS FOR PROJECT: FROM TARBORO, NC
MOISTURE-DENSITY RELATIONSHIP TEST TITAN ATLANTIC GROUP, INC.	Fig. No. 0284-2

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
• 4	0.0	0.0	66.3	33.7	

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
• 27	10	0.610	0.218	0.169					

MATERIAL DESCRIPTION	USCS	AASHTO
• ORANGE BROWN SILTY CLAYEY FINE TO MEDIUM SAND	SC	A-2-4

Project No.: 0284-80

Project: PRINCEVILLE DIKE REPAIR: PRINVEVILLE, NC

• Location: OFF SITE BORROW FROM ROCKY MOUNT, NC

Date: APRIL 22, 2000

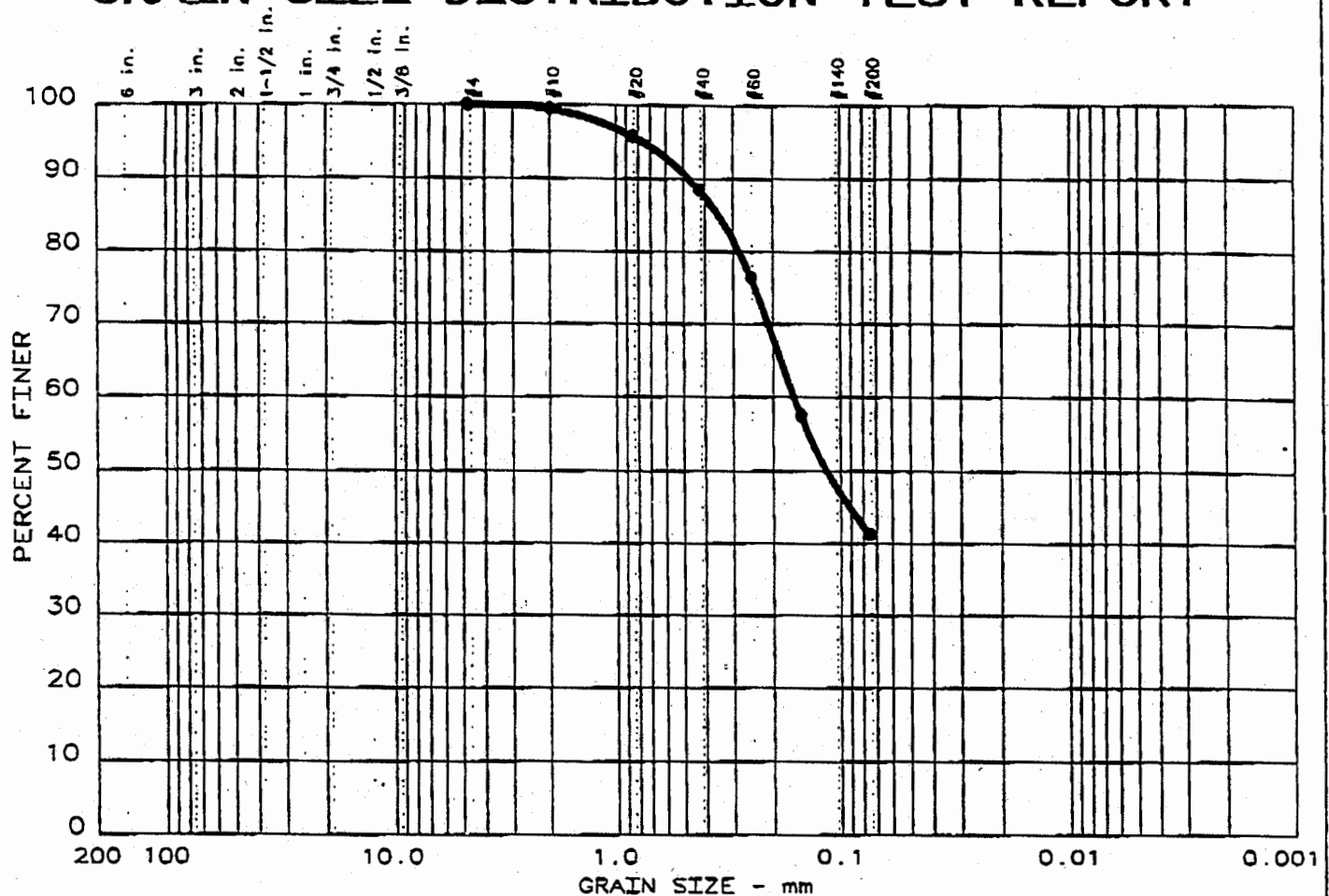
GRAIN SIZE DISTRIBUTION TEST REPORT
TITAN ATLANTIC GROUP, INC.

Remarks:

SOILS PROPOSED FOR USE
 AS EMBANKMENT FILL FOR
 SUBJECT PROJECT

Fig. No.: 0284-1

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
• 16	0.0	0.0	58.8	41.2	

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
• 29	11	0.347	0.160	0.115					

MATERIAL DESCRIPTION	USCS	AASHTO
• YELLOW BROWN SILTY CLAYEY FINE TO MEDIUM SAND	SC	A-6

Project No.: 0284-80

Project: PRINCEVILLE DIKE REPAIR; PRINCEVILLE, NC

• Location: OFF SITE BORROW FROM TARBORO, NC

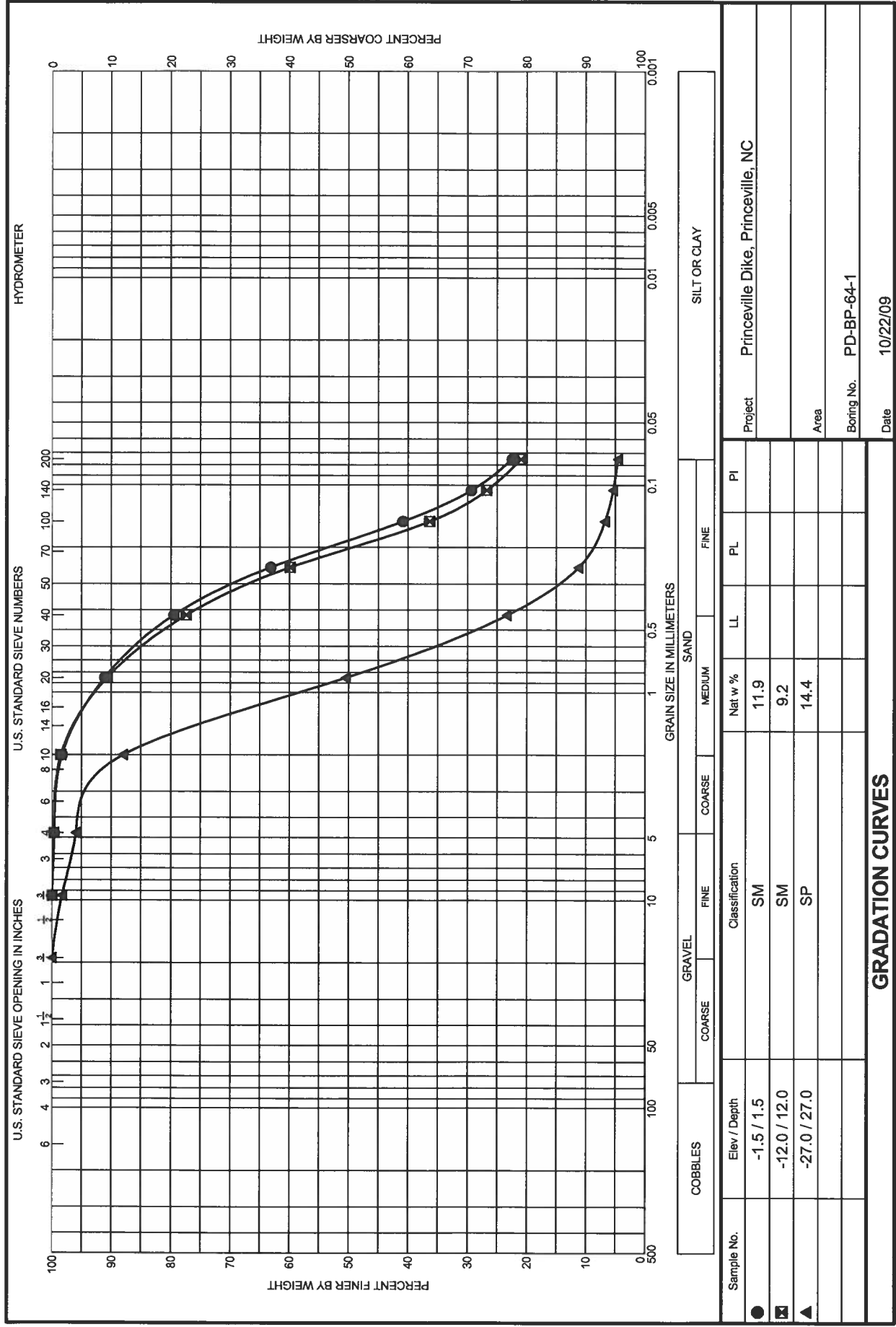
Date: APRIL 22, 2000

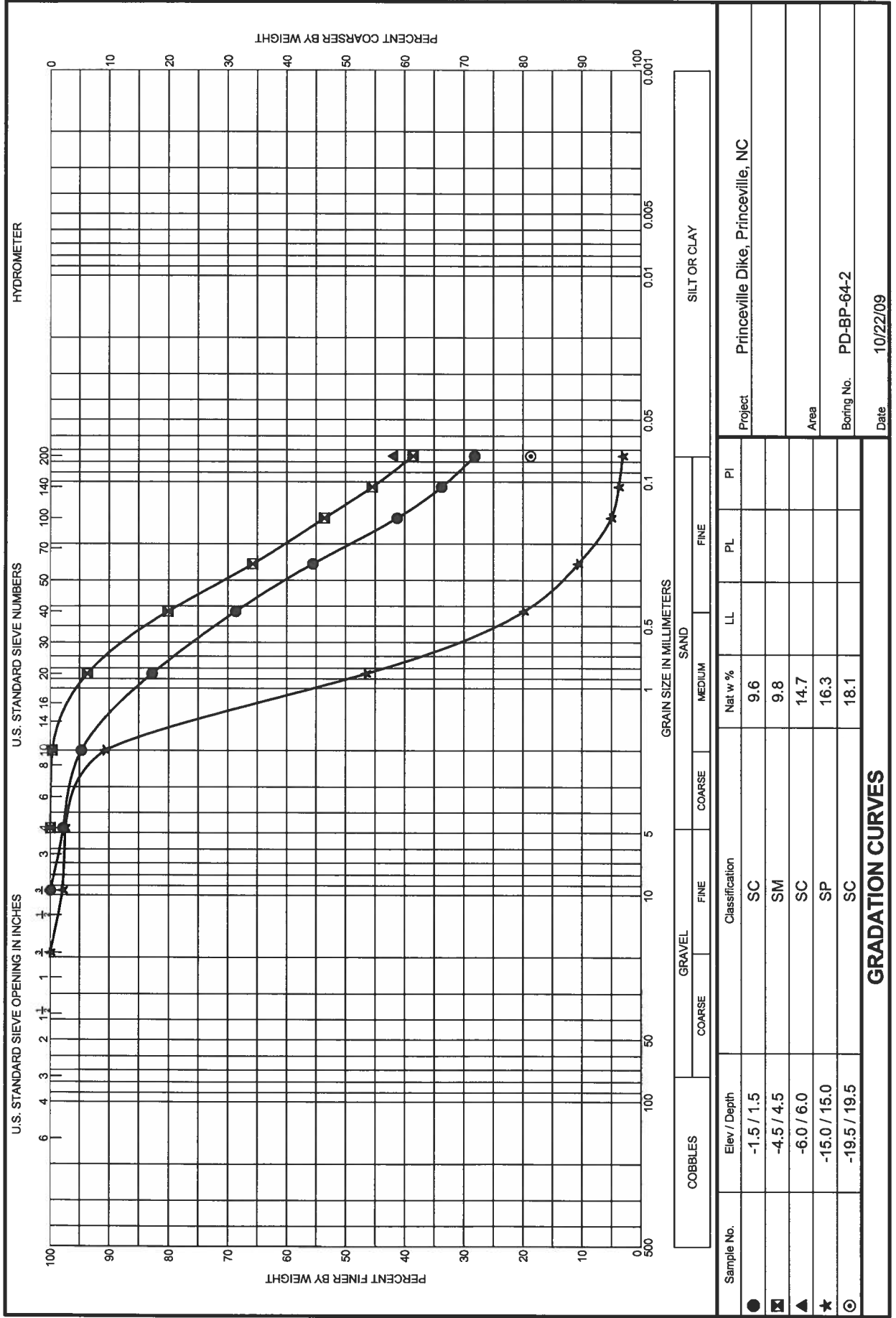
GRAIN SIZE DISTRIBUTION TEST REPORT
TITAN ATLANTIC GROUP, INC.

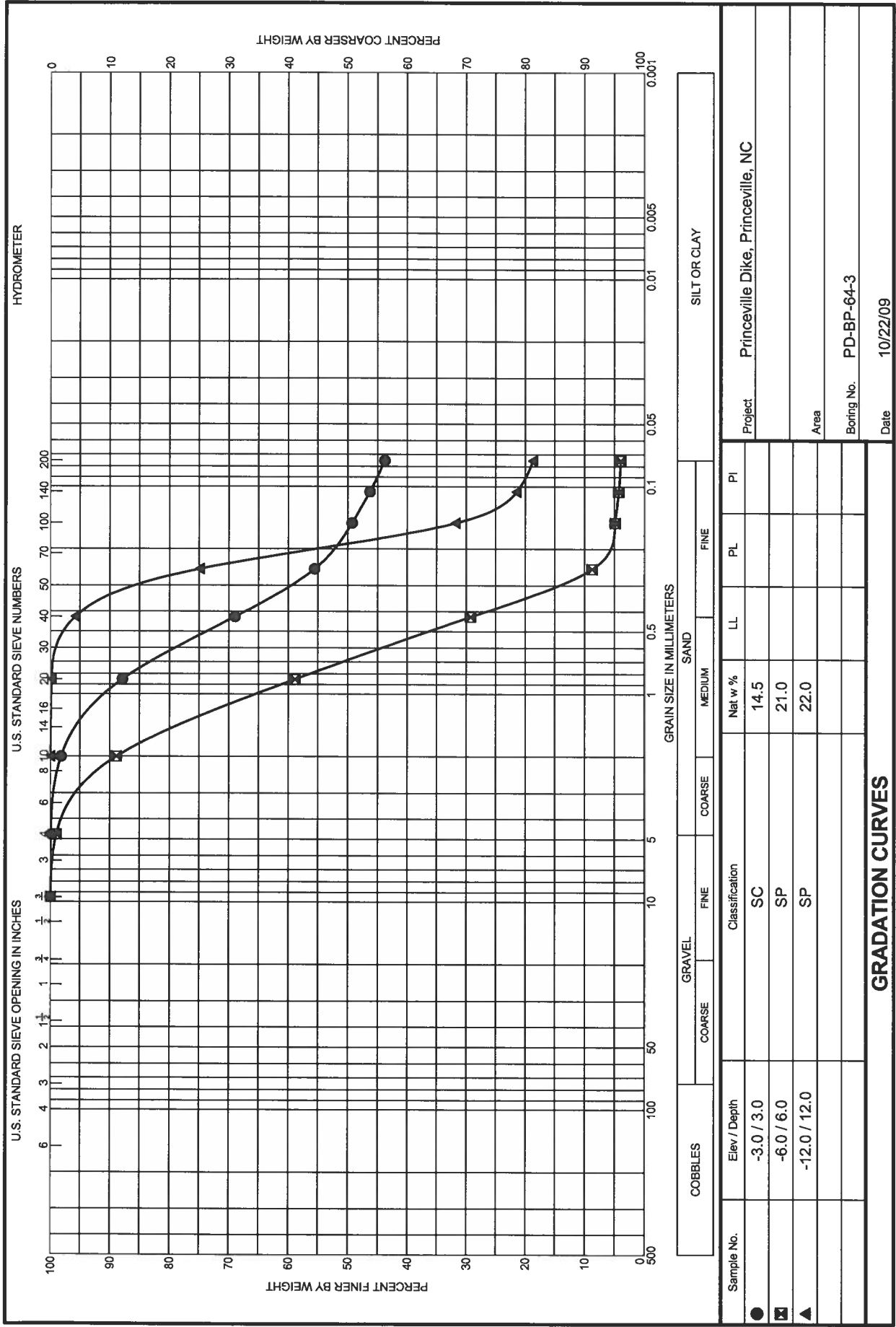
Remarks:

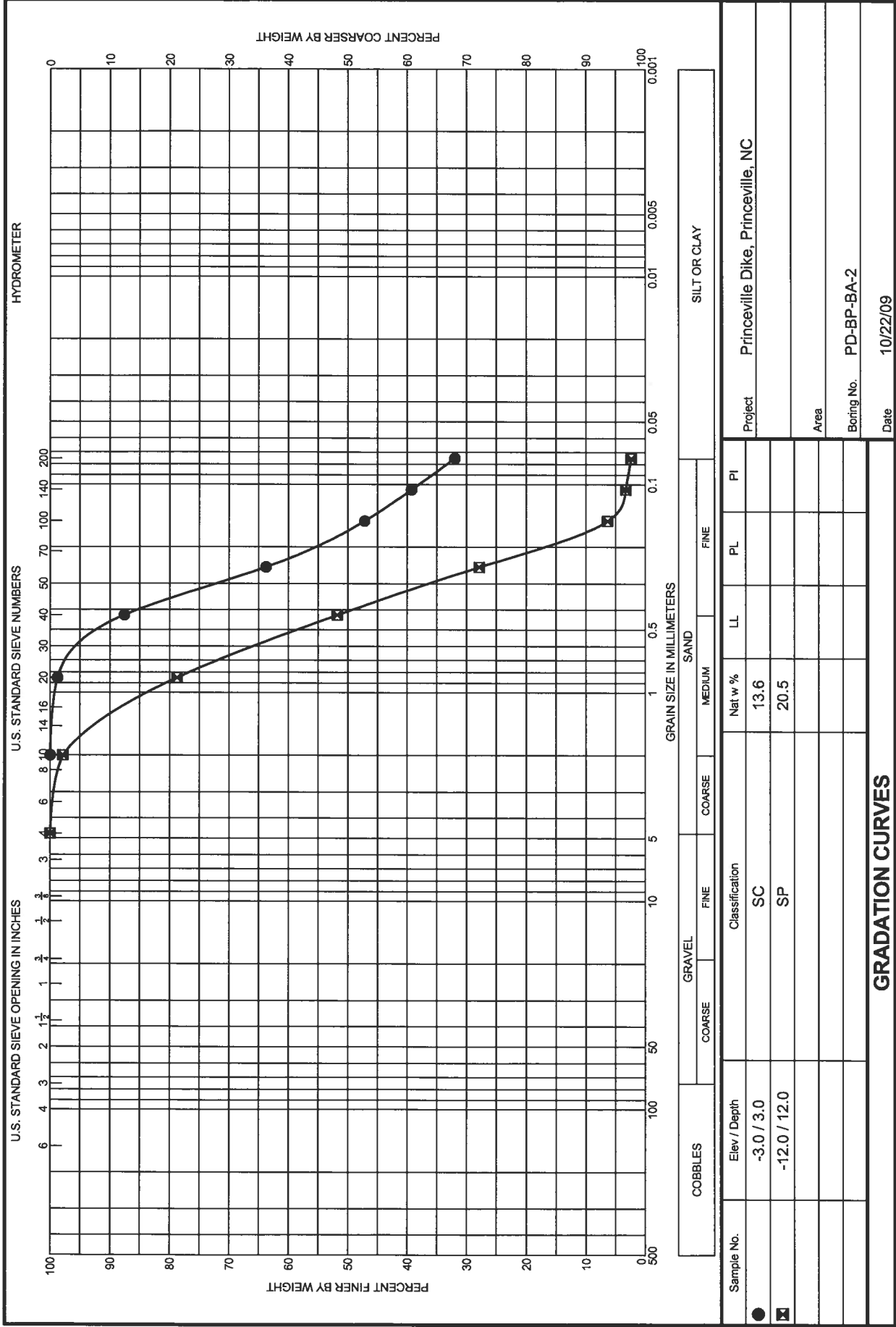
SOILS PROPOSED FOR USE
 AS EMBANKMENT FILL FOR
 SUBJECT PROJECT

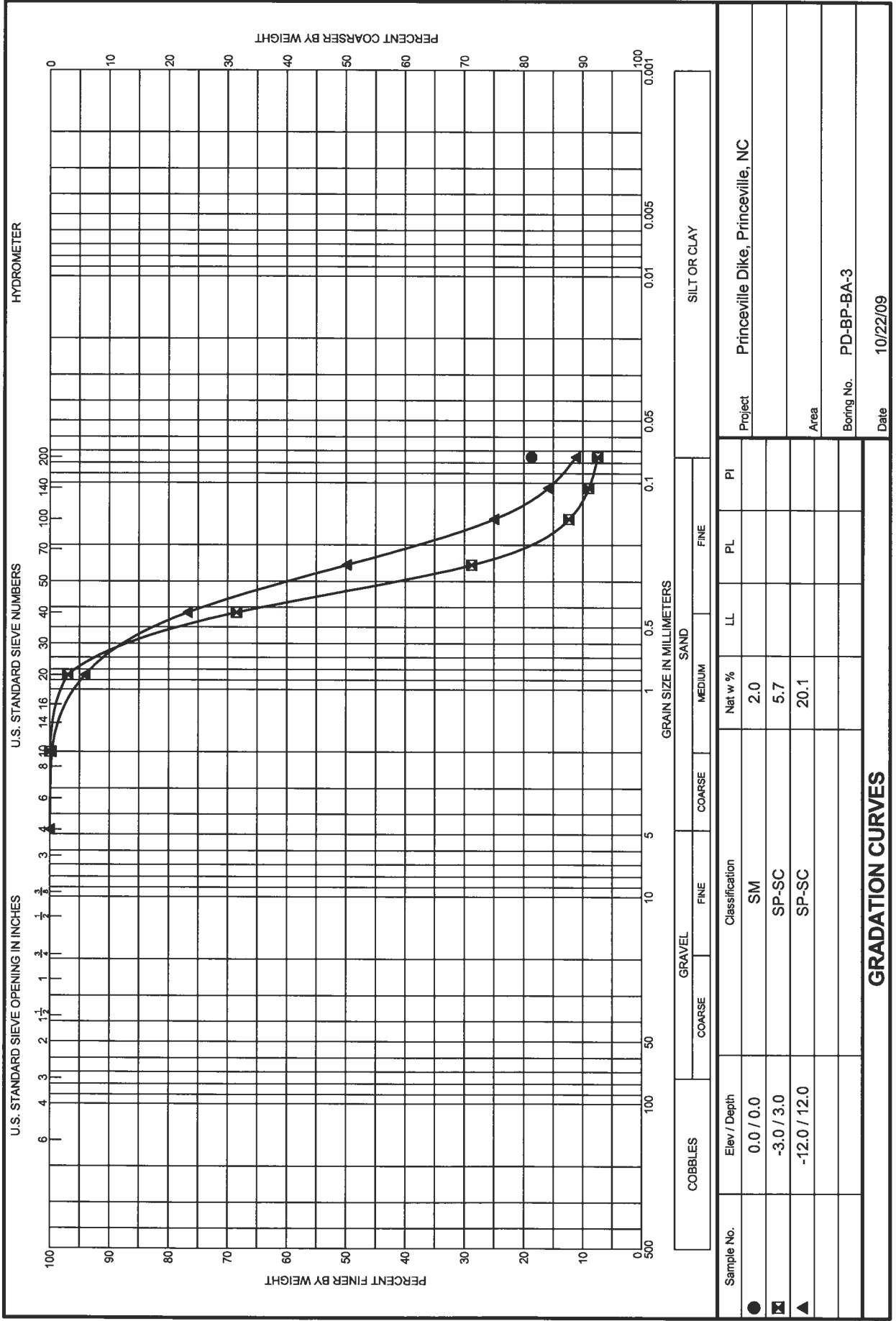
Fig. No.: 0284-2

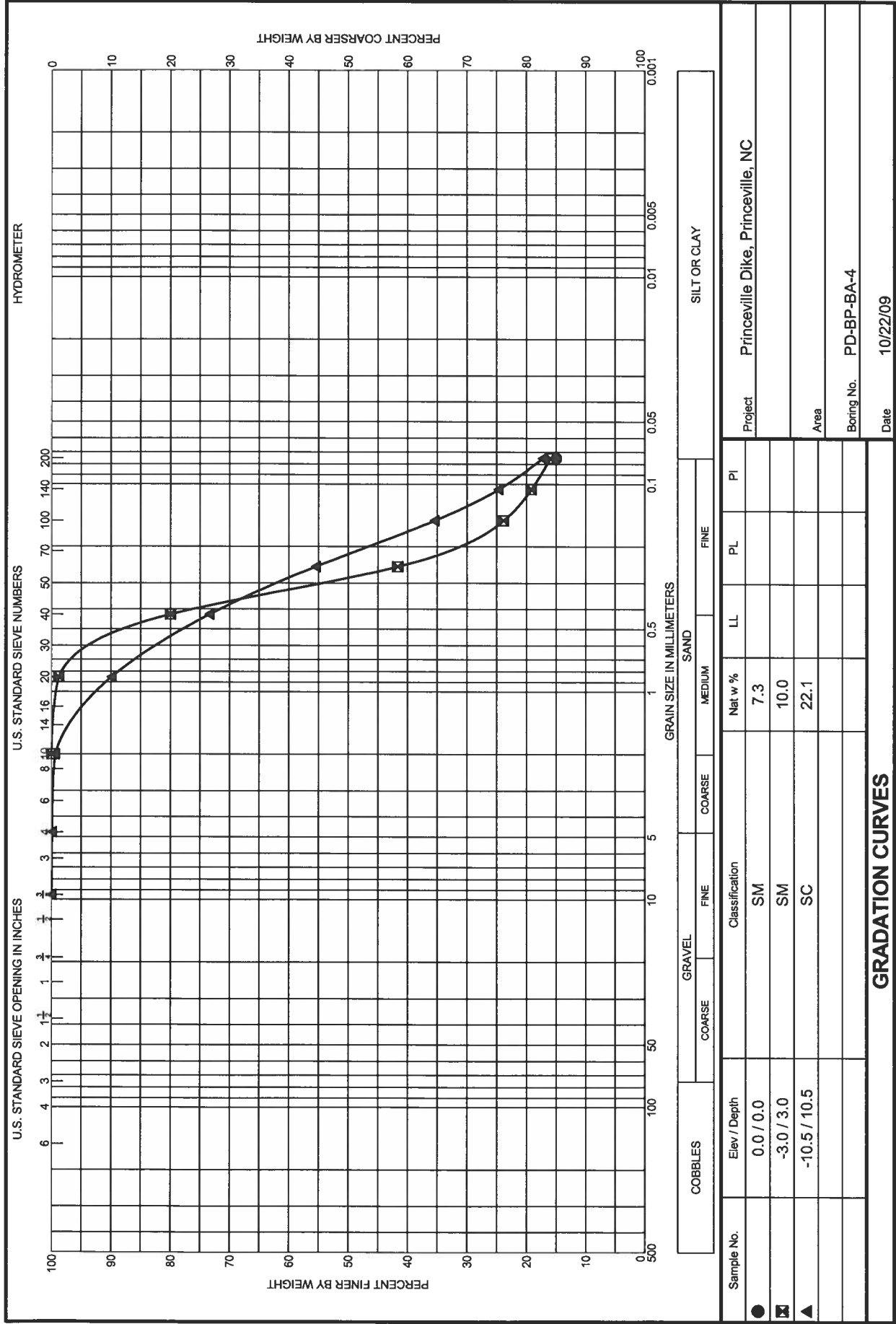


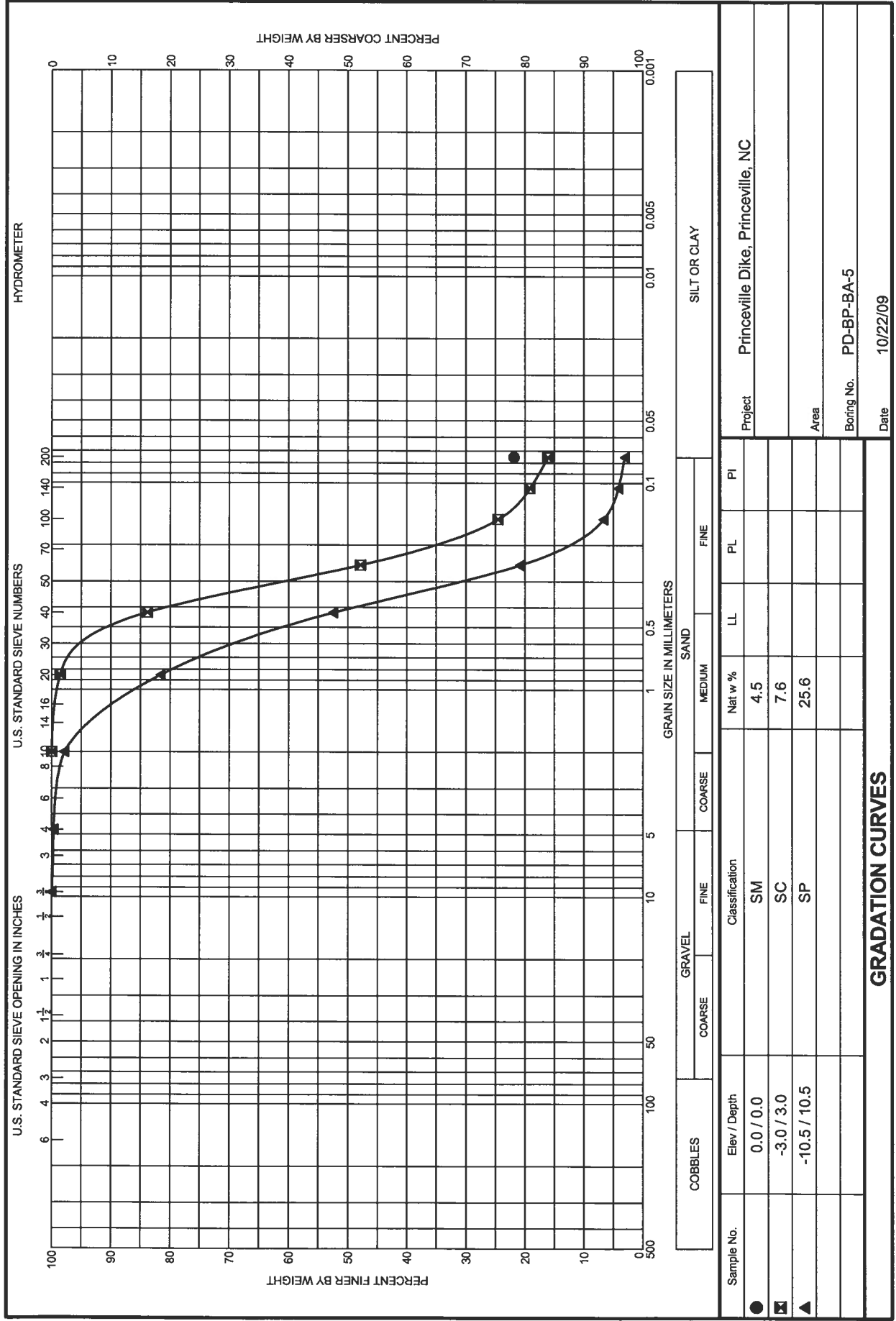


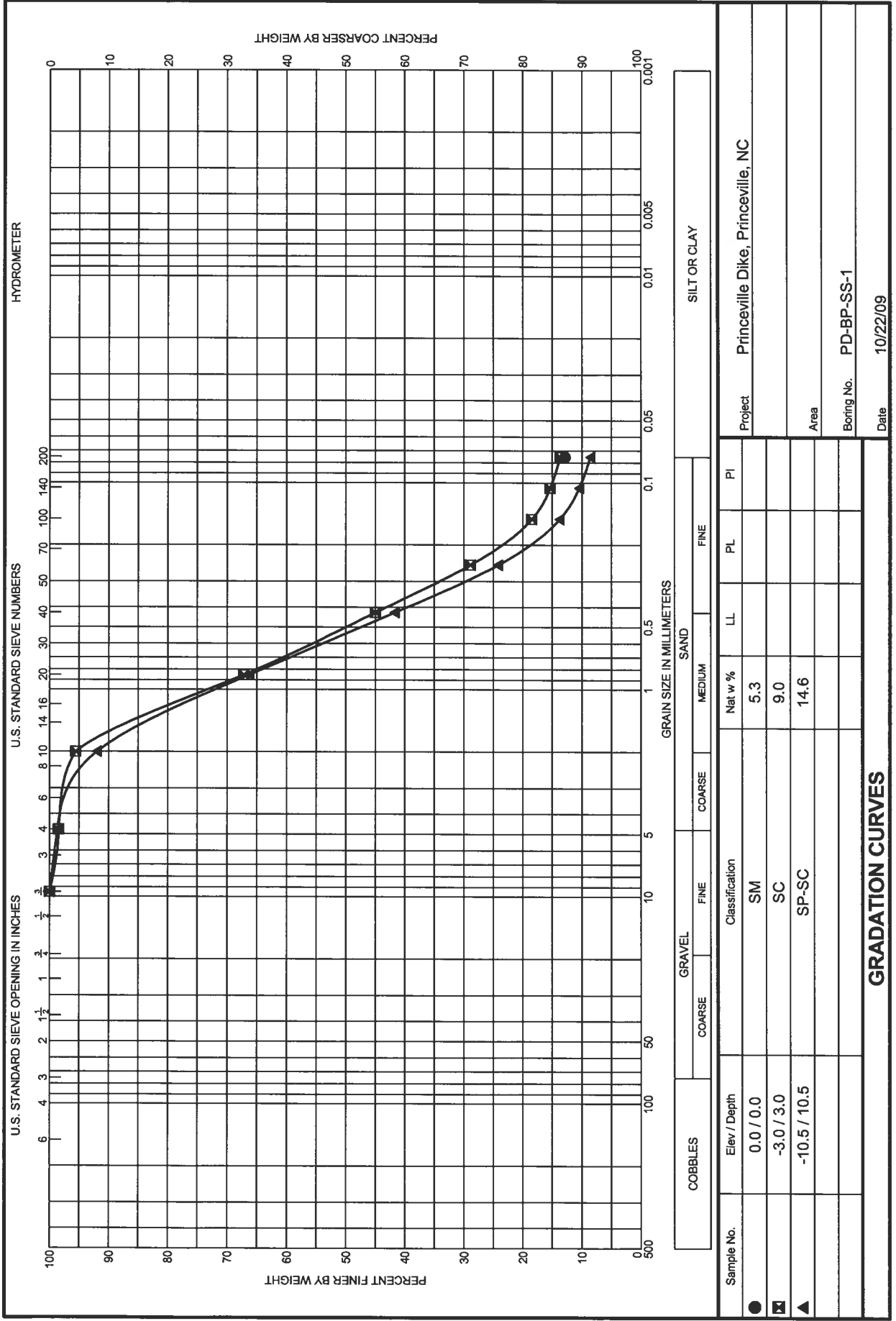


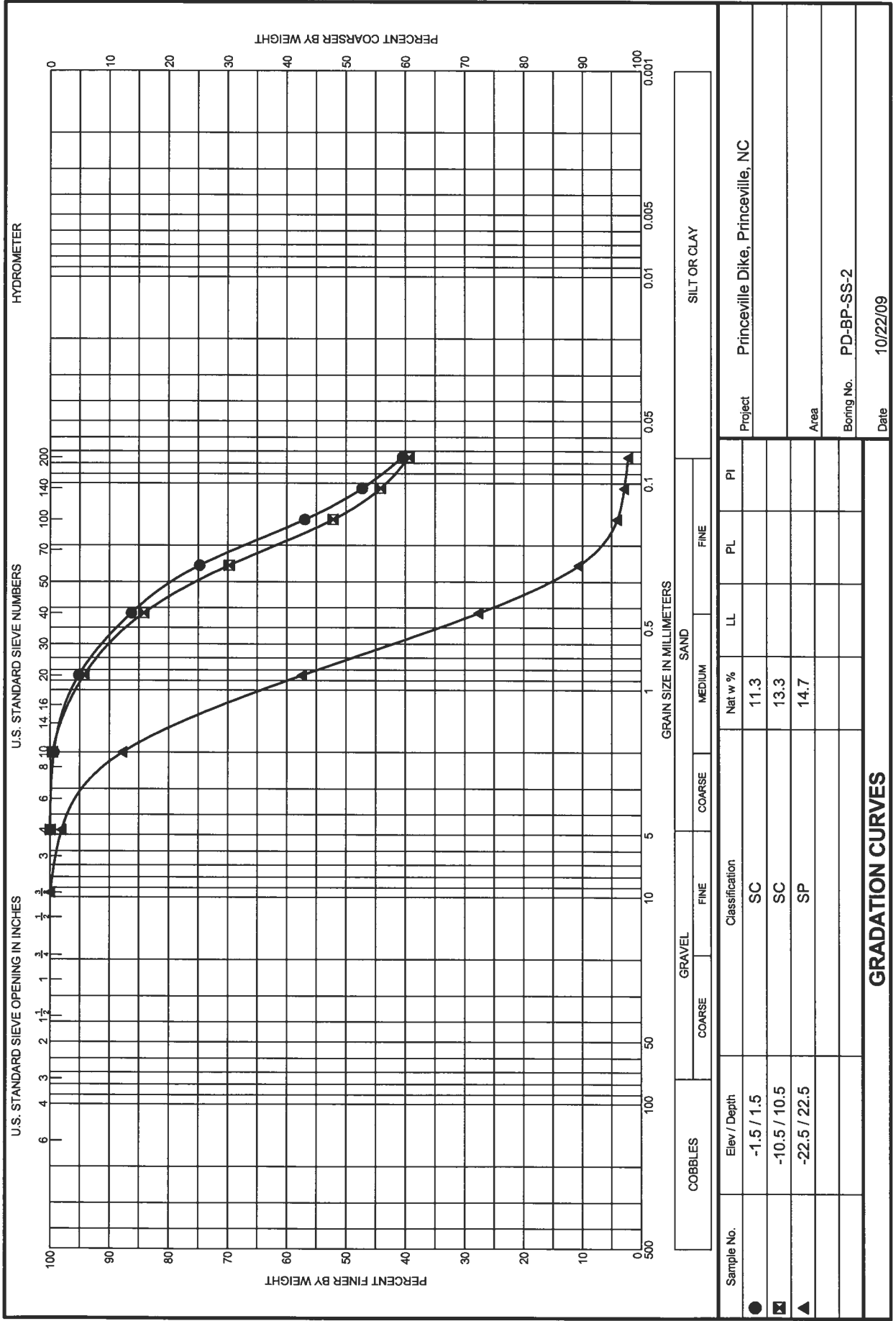


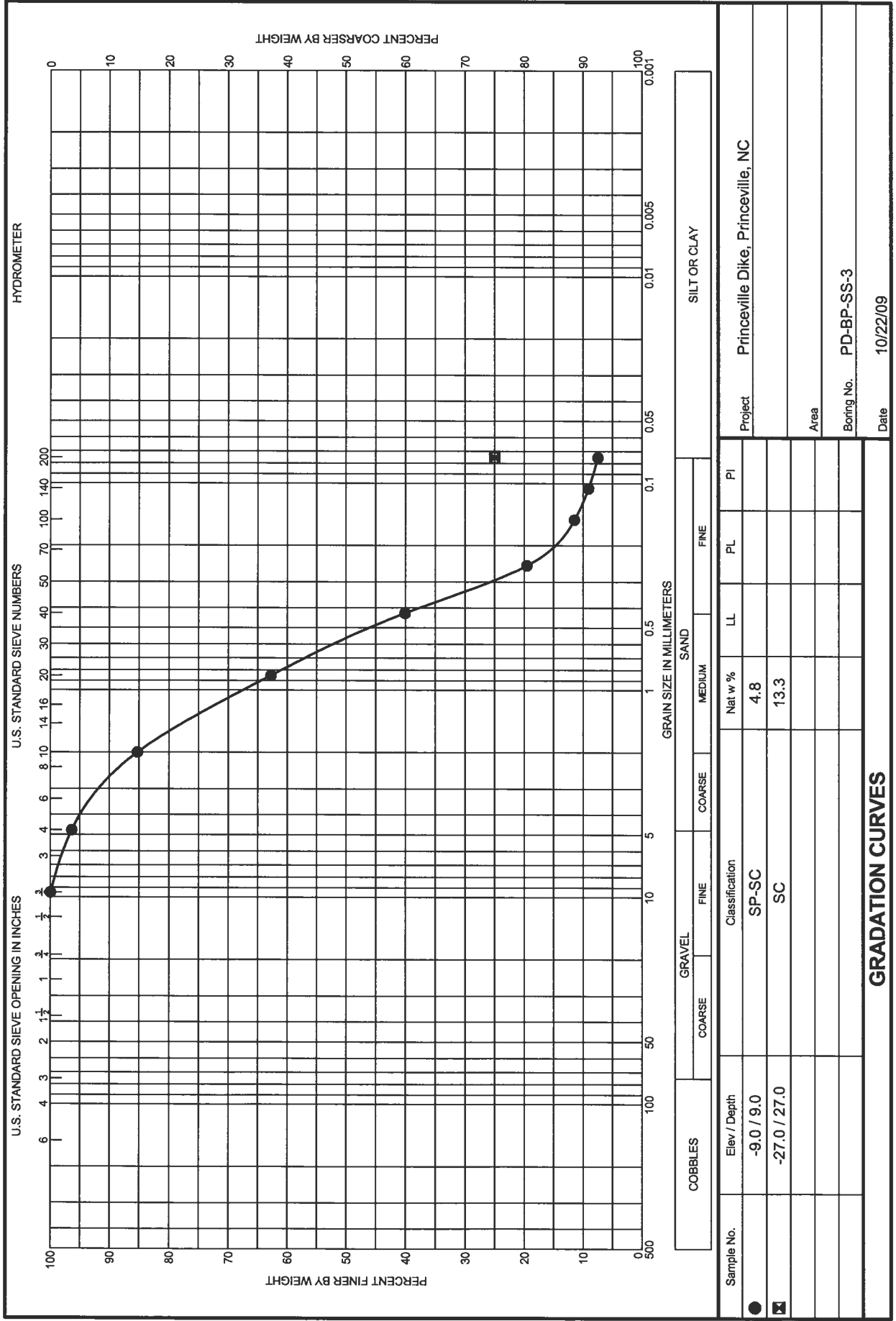


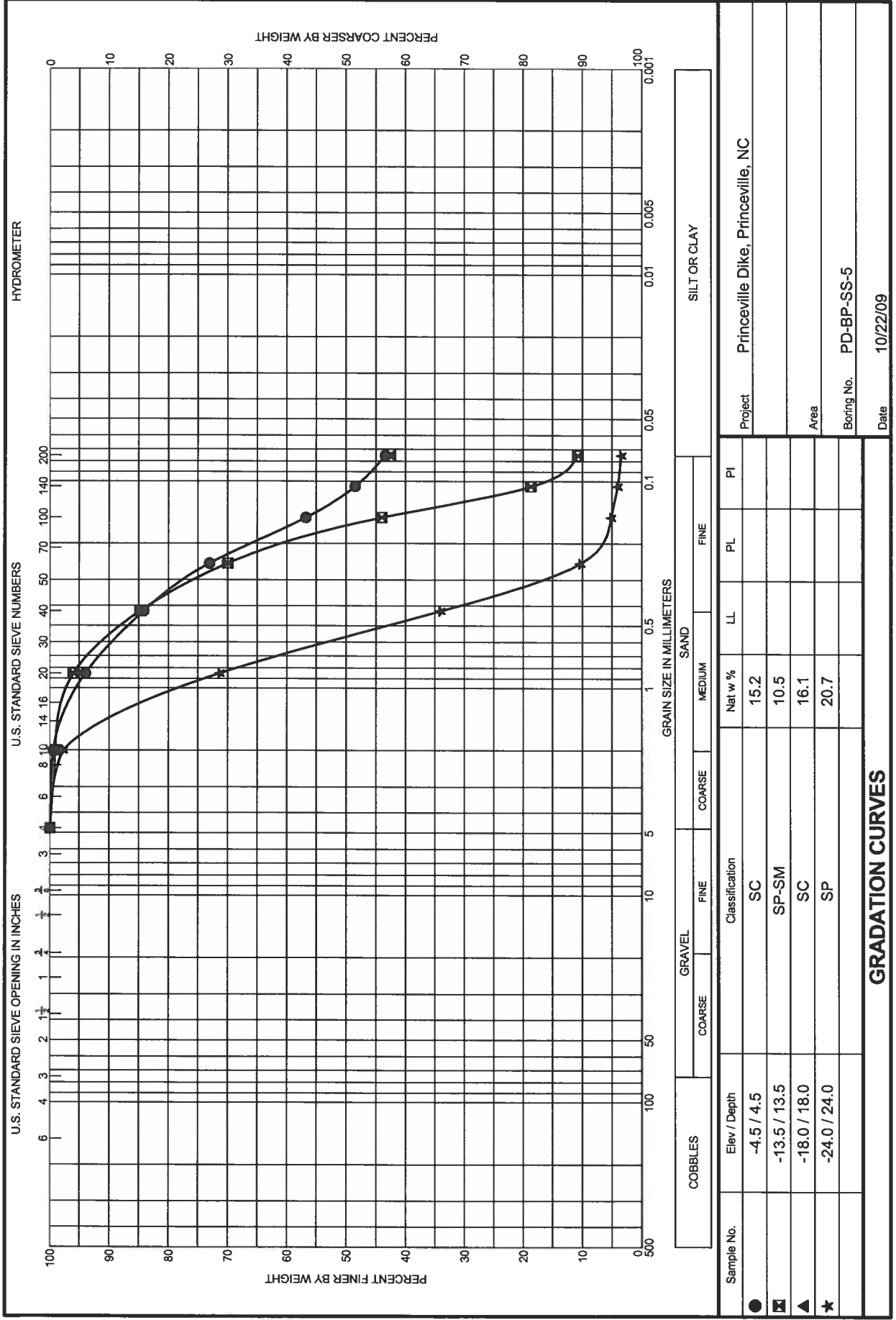


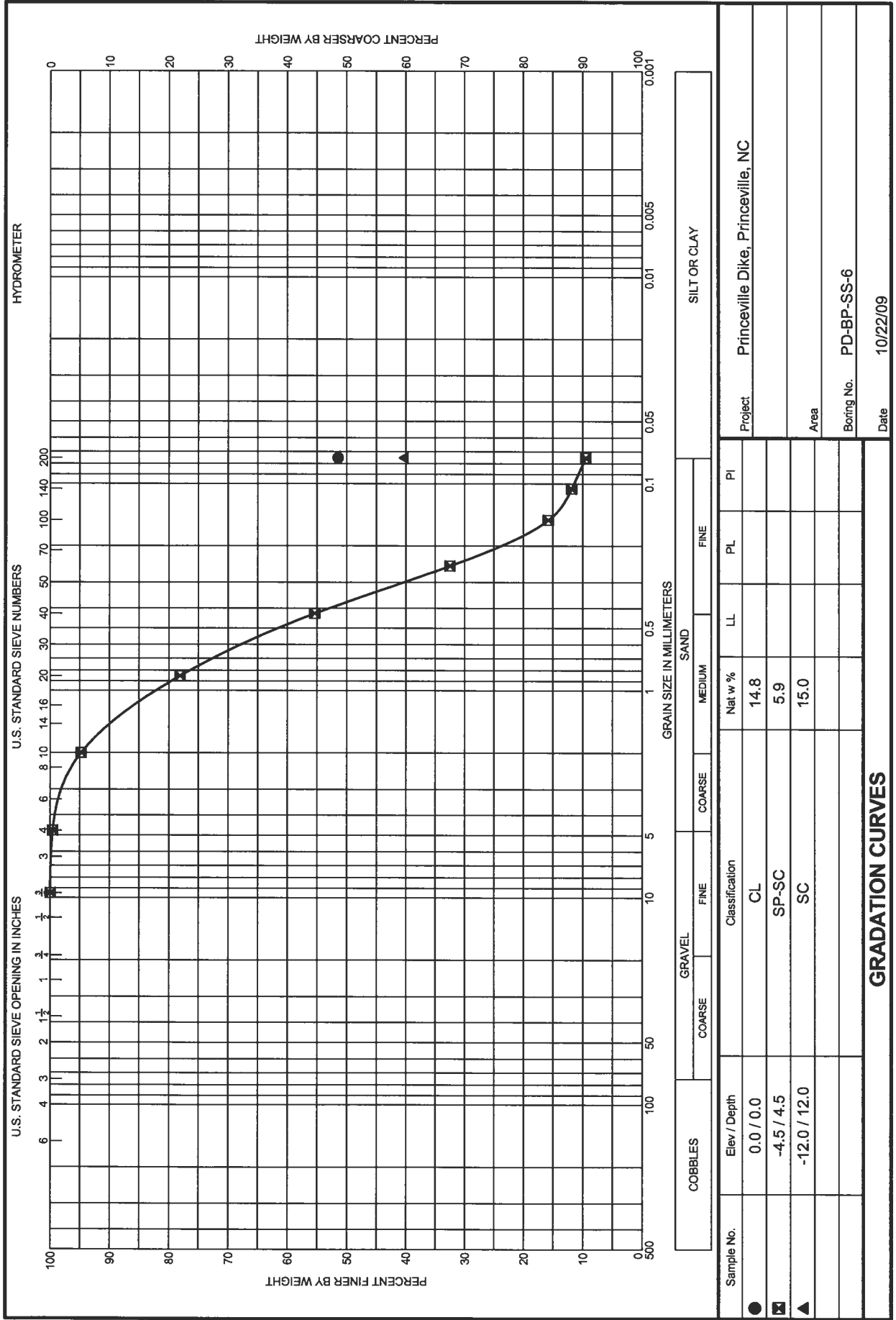


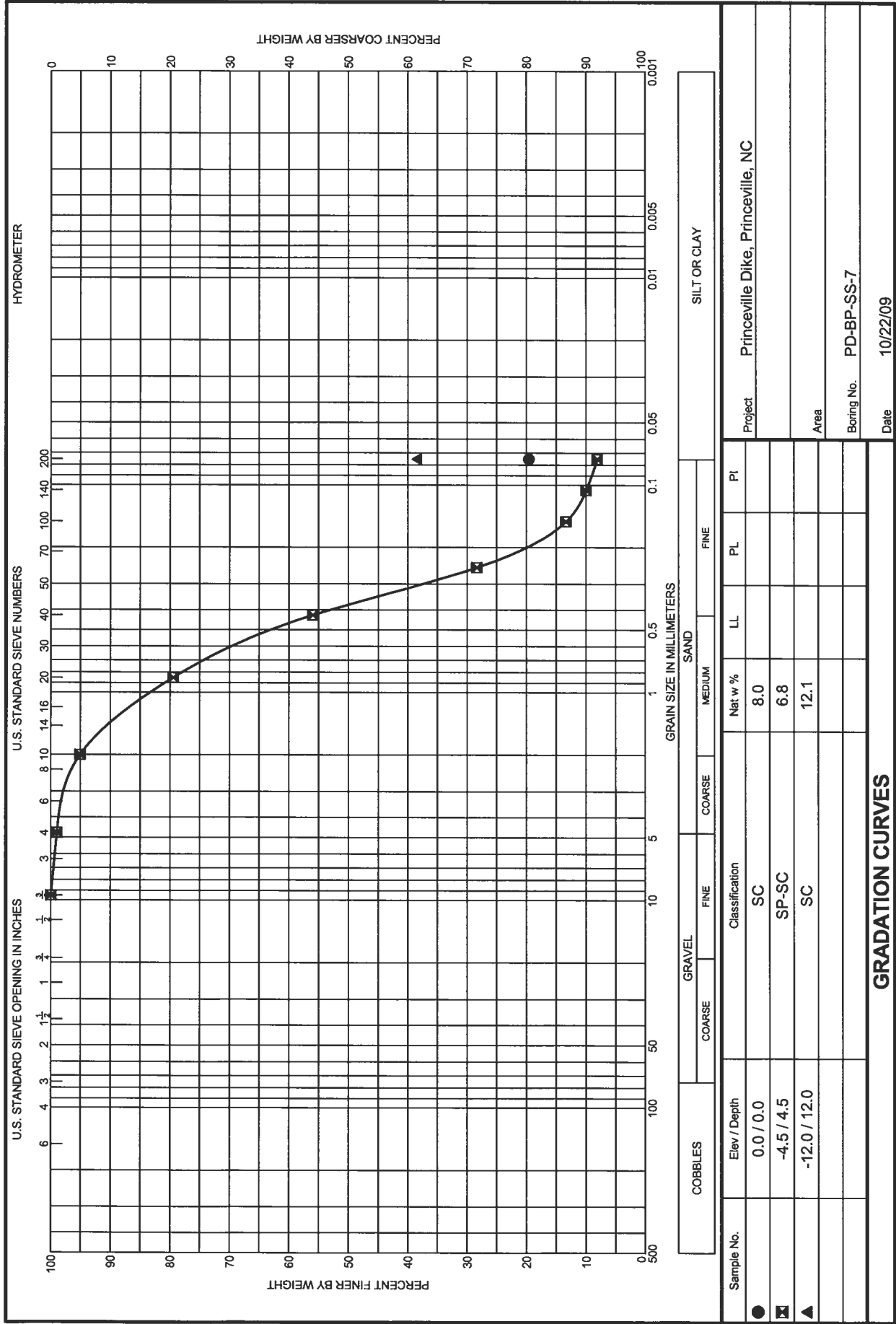


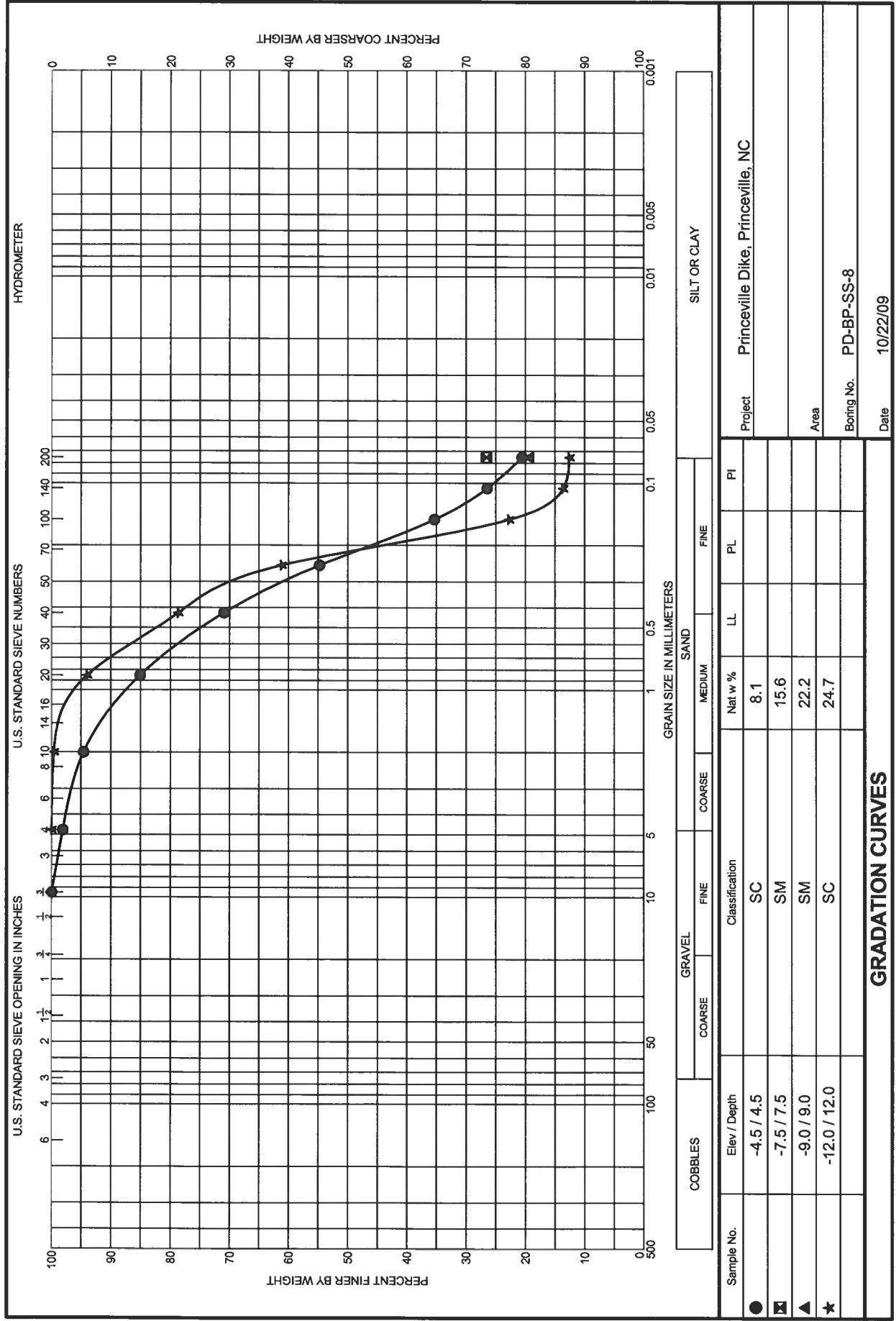


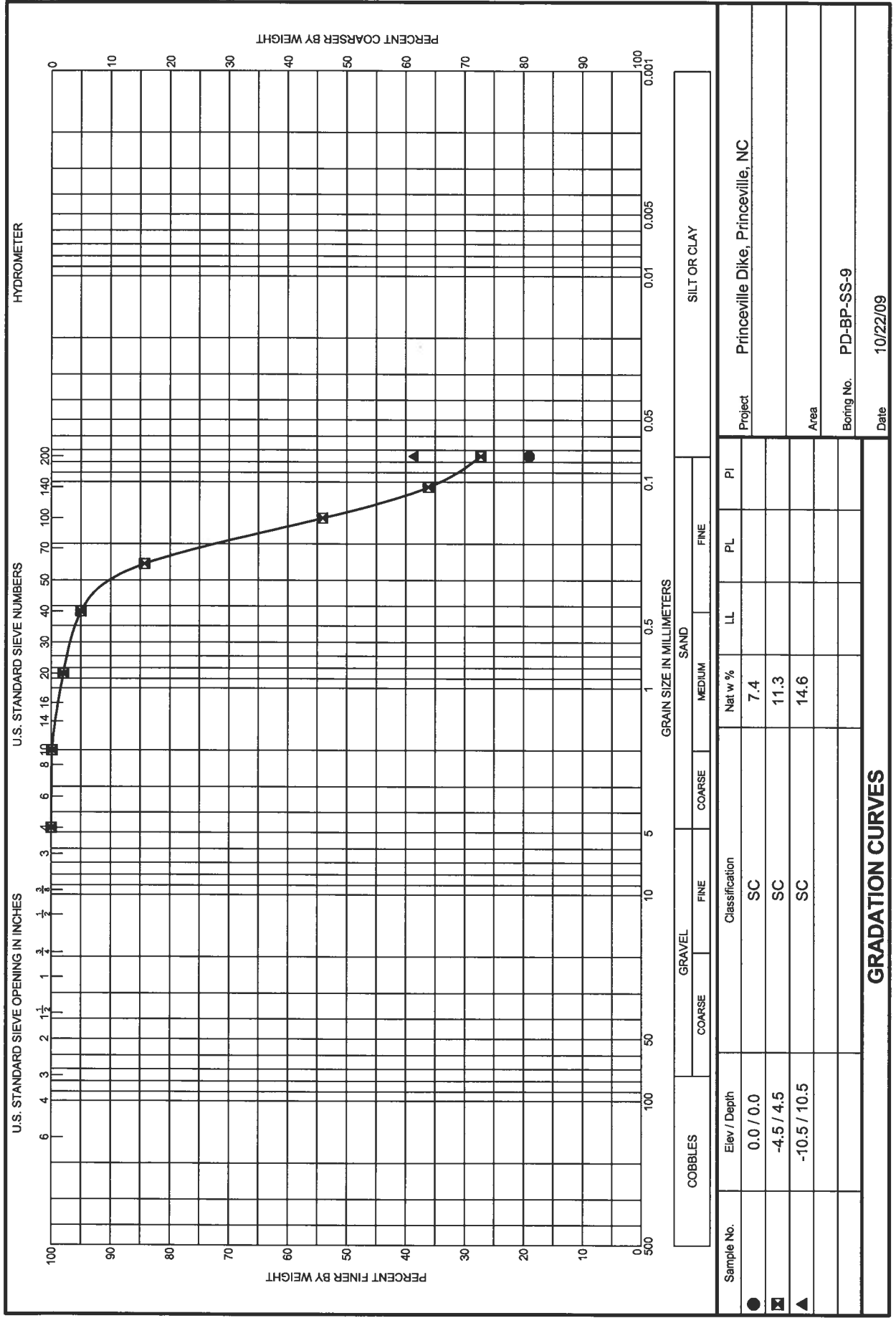












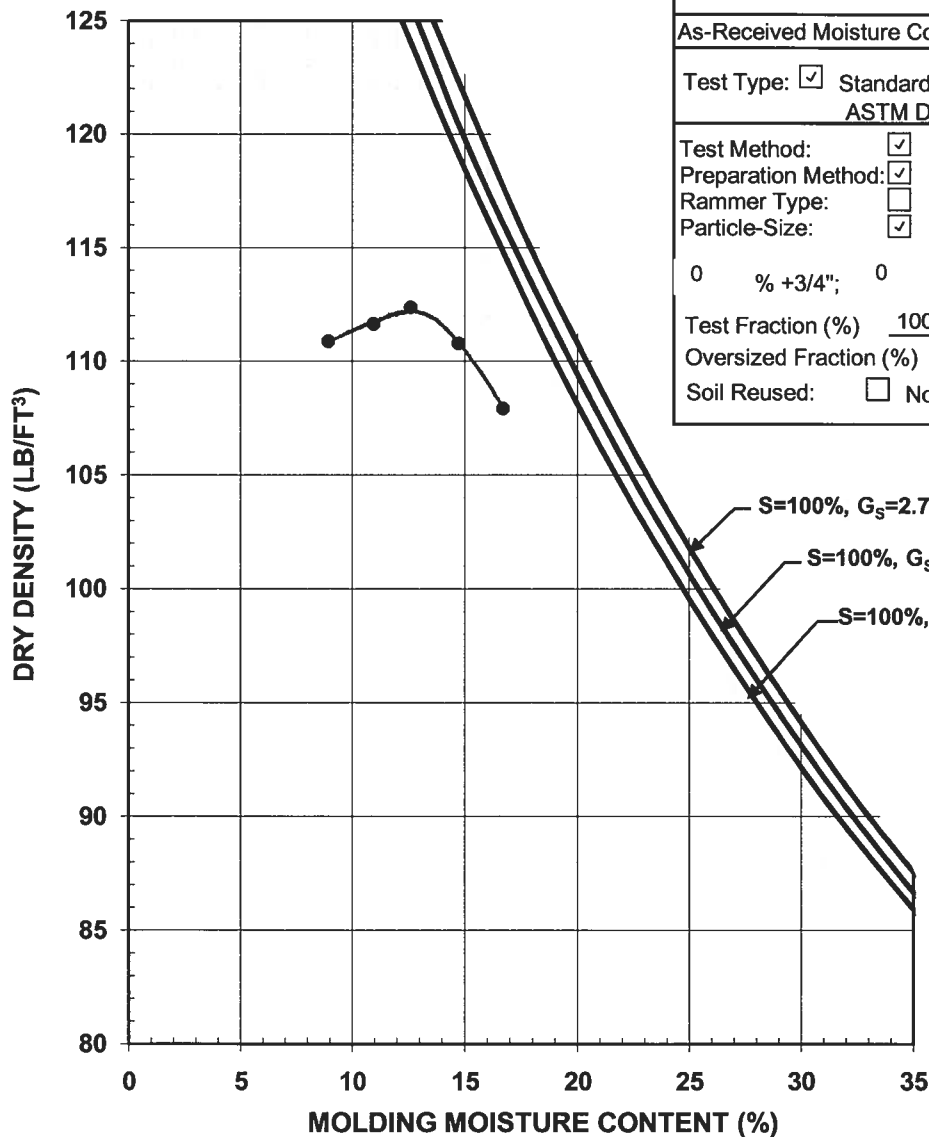
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

PROCTOR COMPACTION TEST REPORT

CLIENT : US Army Corps of Engineers, Wilmington District
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-177

INCOMING SAMPLE NO.: Box 1
 BORING: _____ SAMPLE: _____
 DEPTH: _____ ft; _____ m
 LABORATORY IDENTIFICATION NO.: 09177/Box1
 SAMPLE DESCRIPTION: Lt brown sand with clay trace roots

DATE SAMPLE RECEIVED: _____
 DATE TEST SET-UP: 09/24/09
 DATE REPORTED: 09/25/09



Comments: _____

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client or Ardaman & Associates, Inc. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Checked By: _____ Date: _____

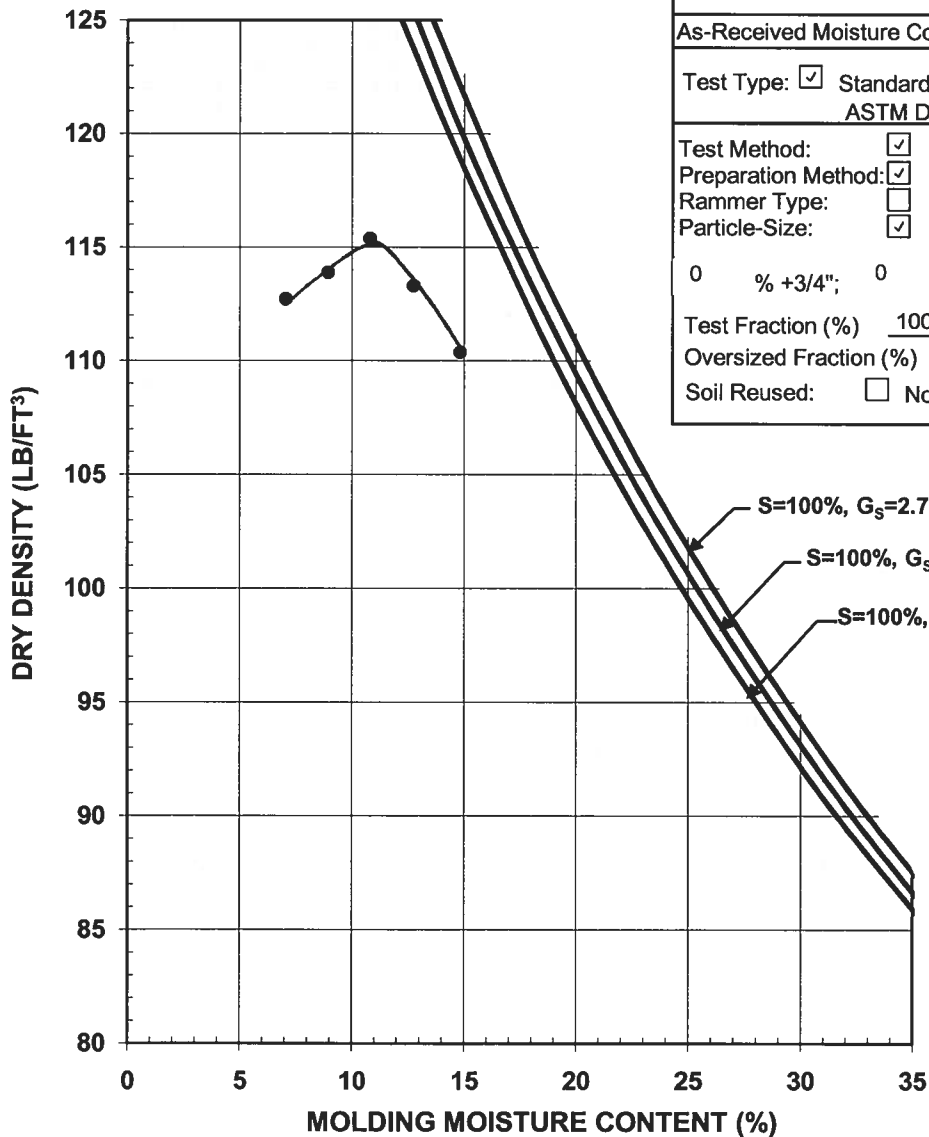
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

PROCTOR COMPACTION TEST REPORT

CLIENT : US Army Corps of Engineers, Wilmington District
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-177

INCOMING SAMPLE NO.: Box 2
 BORING: _____ SAMPLE: _____
 DEPTH: _____ ft; _____ m
 LABORATORY IDENTIFICATION NO.: 09177/Box2
 SAMPLE DESCRIPTION: Lt brown sand with silt trace roots

DATE SAMPLE RECEIVED: _____
 DATE TEST SET-UP: 09/24/09
 DATE REPORTED: 09/25/09



TEST METHOD AND SPECIMEN PREPARATION	
As-Received Moisture Content (ASTM D 2216): <u>3.2</u> %	
Test Type: ☒ Standard Effort ASTM D 698	☐ Modified Effort ASTM D 1557
Test Method: ☒ A ☐ B ☐ C	
Preparation Method: ☒ Moist ☐ Dry	
Rammer Type: ☐ Manual ☒ Mechanical	
Particle-Size: ☒ Estimated ☒ Measured	
0 % +3/4"; 0 % +3/8"; <1 % +No.4	
Test Fraction (%) <u>100</u>	
Oversized Fraction (%) <u>0</u>	
Soil Reused: ☐ No ☒ Yes	____ Number of Times

Optimum Moisture Content (%)
11

Maximum Dry Density (lb/ft³)
115.4

Comments: _____

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Checked By: _____ Date: _____

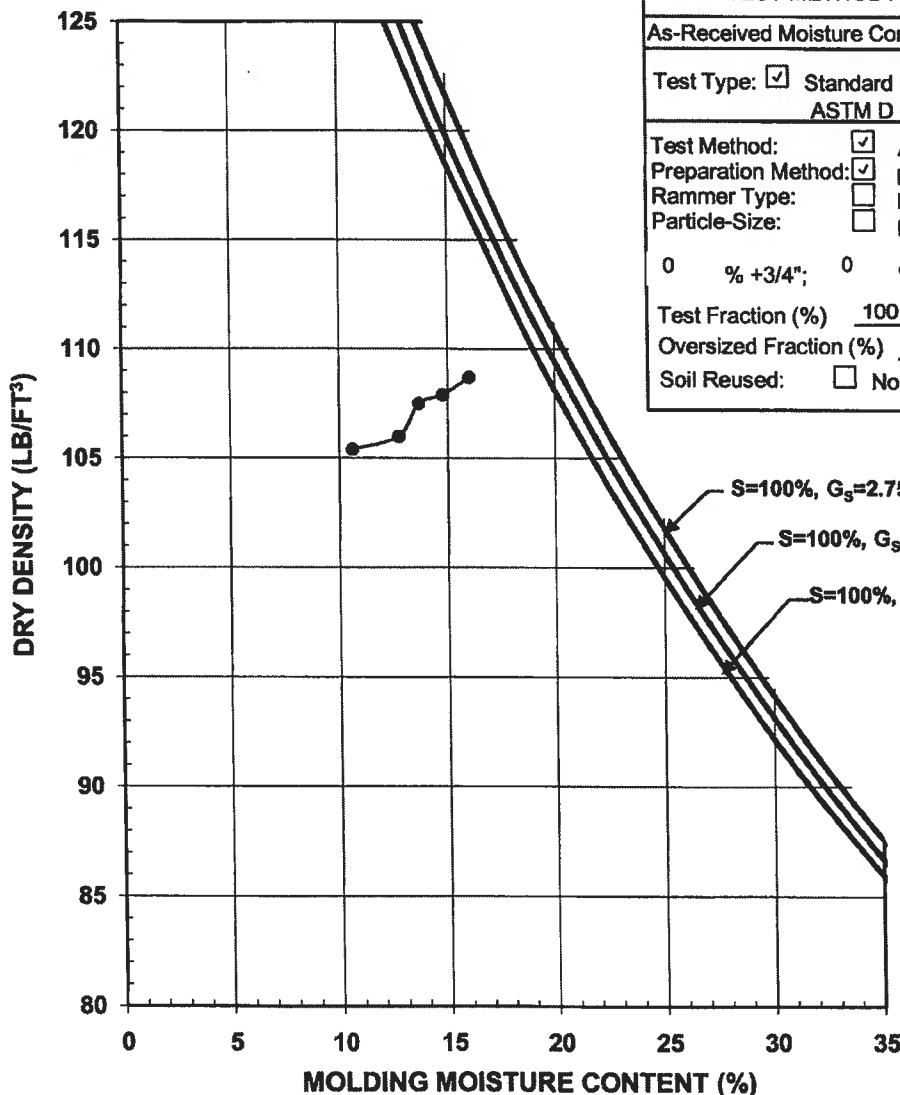
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

PROCTOR COMPACTION TEST REPORT

CLIENT : US Army Corps of Engineers, Wilmington District
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-177

INCOMING SAMPLE NO.: Box 3
 BORING: _____ SAMPLE: _____
 DEPTH: _____ ☐ ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09177/Box3
 SAMPLE DESCRIPTION: Lt brown sand with trace roots

DATE SAMPLE RECEIVED: _____
 DATE TEST SET-UP: 09/24/09
 DATE REPORTED: 09/25/09



TEST METHOD AND SPECIMEN PREPARATION			
As-Received Moisture Content (ASTM D 2216): <u>2</u> %			
Test Type: ☒ Standard Effort ASTM D 698		☐ Modified Effort ASTM D 1557	
Test Method: ☒ A ☐ B ☐ C			
Preparation Method: ☒ Moist ☐ Dry			
Rammer Type: ☐ Manual ☒ Mechanical			
Particle-Size: ☐ Estimated ☒ Measured			
0 % +3/4"; 0 % +3/8"; 0.5 % +No.4			
Test Fraction (%) <u>100</u>			
Oversized Fraction (%) <u>0</u>			
Soil Reused: ☐ No ☒ Yes		_____ Number of Times	

Optimum Moisture Content (%)
16

Maximum Dry Density (lb/ft³)
108.7

Comments: _____

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Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

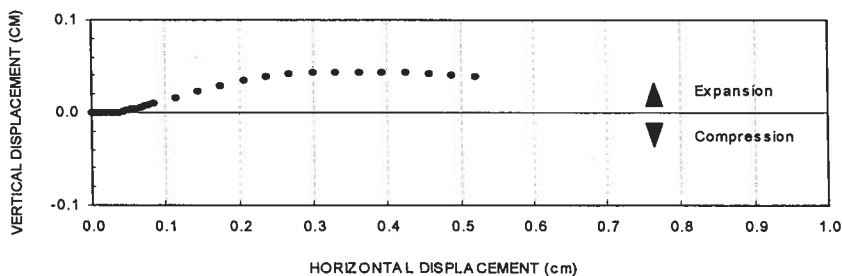
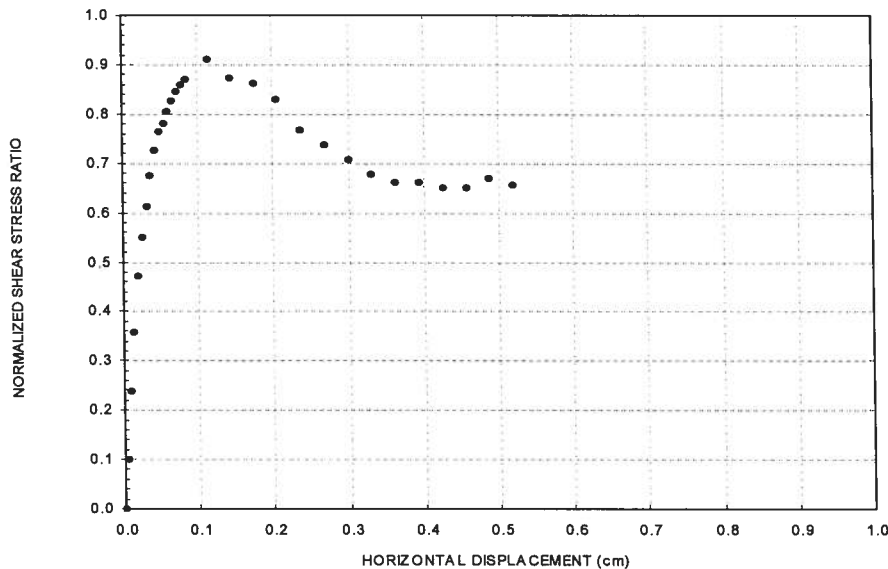
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/08/09
 DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 1 of 3
 BORING - - SAMPLE -
 DEPTH - ft; - m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box1
 SAMPLE DESCRIPTION: Brown medium to fine sand with silt, SP-SM

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{vs} (%)
126.71	2.79	5.83	13.4	106.2	64	0.25	106.2	0.0	3.6	17.6	105.0	81	+1.4



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other: _____

Specimen Type: ☒ Circular

☐ Square

Sample Type: ☐ Undisturbed

☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.25 kg/cm²

- kg/cm²

- kg/cm²

- kg/cm²

Inundated at 0.25 kg/cm²

Displacement Rate: 0.38 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.11	0.912	42.4°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.52	0.655	33.2°

G_s: 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☒ ASTM D 422	☐ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	126.71	Soil Passing (% dry wt. basis)	100	100	99.8	98.6	87.7	67.1	43.7	23.7	16.1	11.7

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client or Ardaman & Associates, Inc. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing of the test report, prior to being discarded, unless a longer storage period is requested in writing and accepted by Ardaman & Associates, Inc.

Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; γ_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/09/09
 DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 1 of 3
 BORING - SAMPLE -
 DEPTH - ☐ ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box1
 SAMPLE DESCRIPTION: Brown medium to fine sand with silt, SP-SM

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _e (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{ve} (%)	t _c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{vs} (%)
127.29	2.79	5.83	12.8	106.7	82	0.52	107.0	-0.2	3.7	18.4	106.2	88	+0.8

HORIZONTAL DISPLACEMENT (cm)

HORIZONTAL DISPLACEMENT (cm)

Test Methods & Procedures

☒ ASTM Standard D 3080
☐ Other: _____

Specimen Type: ☒ Circular
☐ Square

Sample Type: ☐ Undisturbed
☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.16	kg/cm ²
0.52	kg/cm ²
-	kg/cm ²
-	kg/cm ²

Inundated at 0.16 kg/cm²
 Displacement Rate: 0.38 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.14	0.811	39.0°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.52	0.643	32.8°

G_s: 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D 422 ☒ ASTM D 1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	127.29	Soil Passing (% dry wt. basis)	-	-	-	-	-	-	-	-	-	12.0

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_e = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{ve} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; γ_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

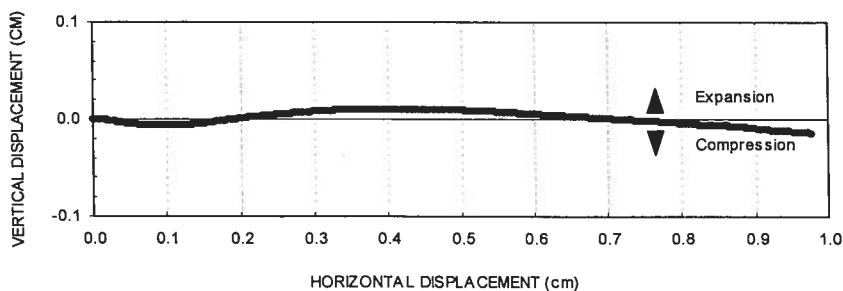
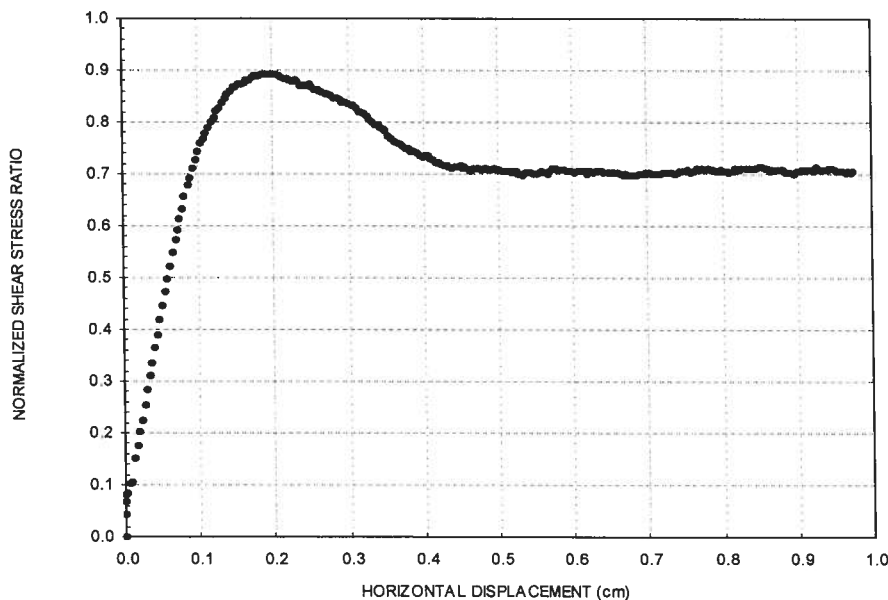
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

INCOMING SAMPLE NO.: Box 1 of 3
 BORING - SAMPLE
 DEPTH ☐ ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box1
 SAMPLE DESCRIPTION: Brown medium to fine sand
with silt, SP-SM

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/09/09
 DATE REPORTED: 10/22/09

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{va} (%)
125.69	2.79	5.83	14.3	105.4	66	1.00	107.9	-2.3	3.8	18.6	108.4	94	-0.5



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other:

Specimen Type: ☒ Circular

☐ Square

Sample Type: ☐ Undisturbed

☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.25 kg/cm²

0.50 kg/cm²

1.00 kg/cm²

 kg/cm²

Inundated at 0.25 kg/cm²

Displacement Rate: 0.72 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.19	0.893	41.8°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.98	0.706	35.2°

G_s: 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D 422	☒ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	125.69	Soil Passing (% dry wt. basis)	-	-	-	-	-	-	-	-	-	11.9

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Checked By: Date:

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

CONSOLIDATED DRAINED DIRECT SHEAR TEST

MOHR-COULOMB FAILURE ENVELOPE

CLIENT: USACE

PROJECT: Princeville Flood Reduction Project

FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09

DATE TEST SET-UP: 10/08-09/09

DATE REPORTED: 10/22/09

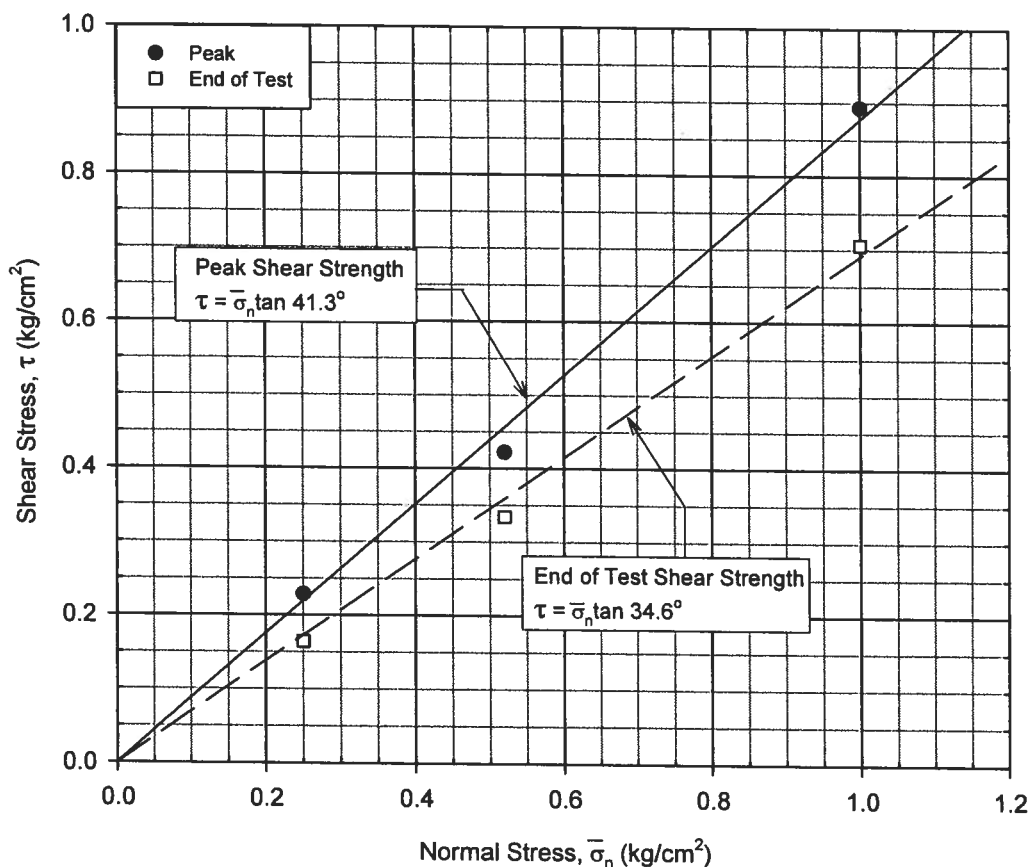
INCOMING SAMPLE NO.: Box 1 of 3

BORING - SAMPLE -

DEPTH - ☐ ft; ☐ m

LABORATORY IDENTIFICATION NO.: 09177/Box1

SAMPLE DESCRIPTION: Brown medium to fine sand with silt, SP-SM



Normal Stress $\bar{\sigma}_n$ (kg/cm ²)	Peak Shear Strength τ (kg/cm ²)	End of Test Shear Strength τ (kg/cm ²)
0.25	0.228	0.164
0.52	0.422	0.334
1.00	0.893	0.706

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Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

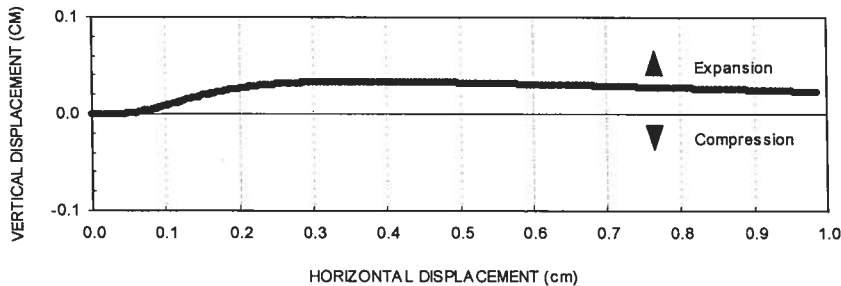
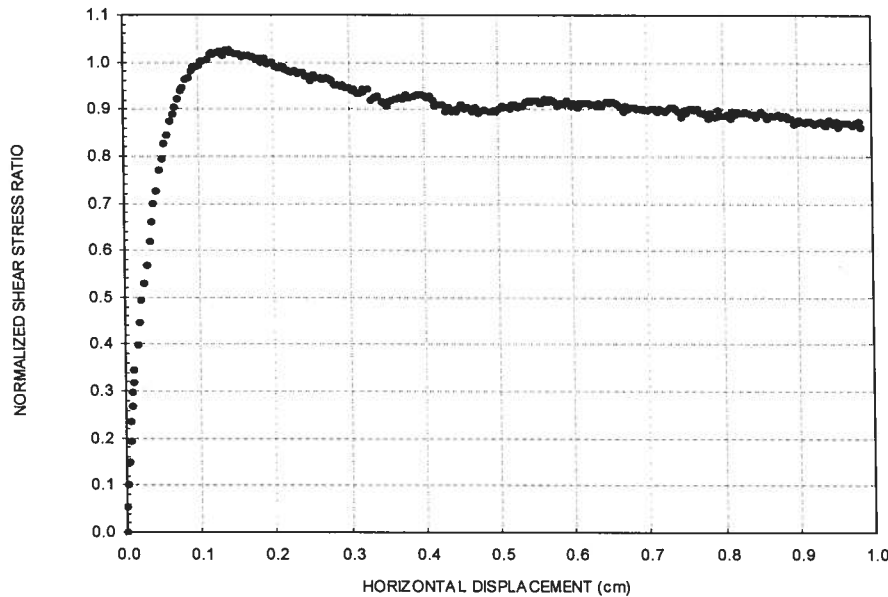
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/12/09
 DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 2 of 3
 BORING: _____ - SAMPLE: _____
 DEPTH: _____ ft; _____ m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box2
 SAMPLE DESCRIPTION: Brown clayey sand, SC

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{vs} (%)
130.53	2.79	5.83	11.2	109.4	58	0.25	109.5	-0.1	4.9	17.3	108.6	88	+0.8



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other: _____

Specimen Type: ☒ Circular

☐ Square

Sample Type: ☐ Undisturbed

☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.25 kg/cm²

- kg/cm²

- kg/cm²

- kg/cm²

Inundated at 0.25 kg/cm²

Displacement Rate: 0.072 cm/hr

Peak Shear Strength

γ_h , cm

0.14

$\tau/\bar{\sigma}_n$

1.026

$\bar{\phi}_{ds}$

45.7°

End of Test Strength

γ_h , cm

0.98

$\tau/\bar{\sigma}_n$

0.863

$\bar{\phi}_{ds}$

40.8°

G_s: 2.65

☒ Assumed

☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☒ ASTM D 422	☐ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	130.53	Soil Passing (% dry wt. basis)	100	100	100	99.2	92.3	71.5	43.6	24.3	18.1	14.6

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; γ_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

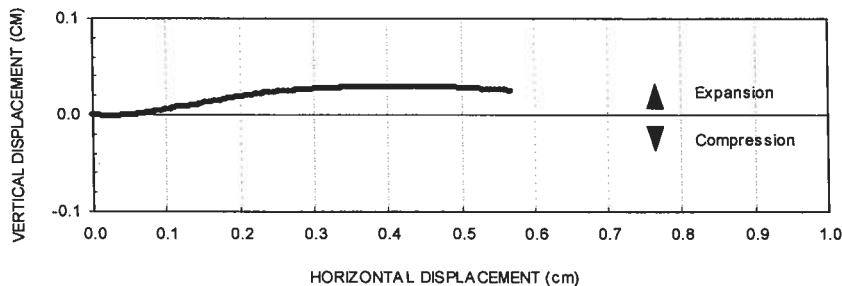
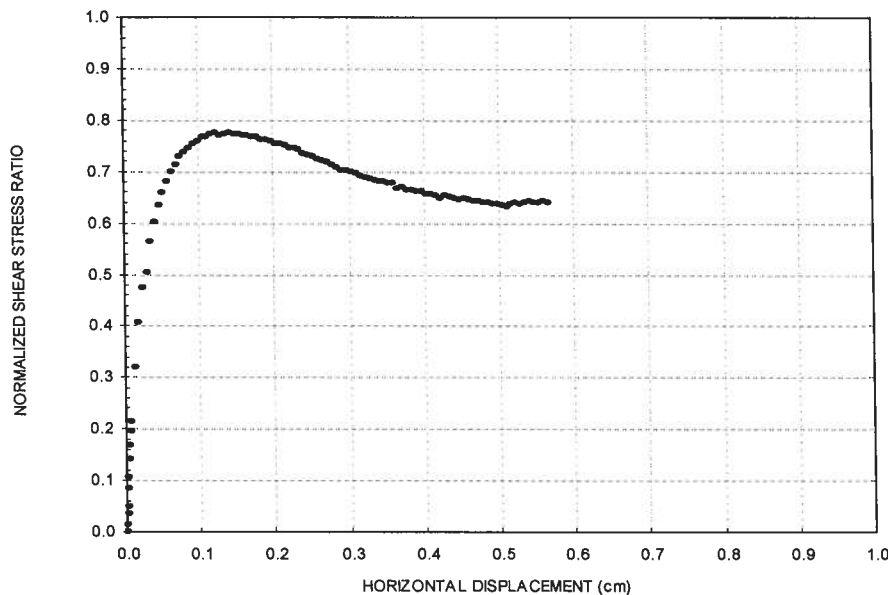
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

INCOMING SAMPLE NO.: Box 2 of 3
 BORING - - SAMPLE -
 DEPTH - - ft; - m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box2
 SAMPLE DESCRIPTION: Brown clayey sand, SC

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/12/09
 DATE REPORTED: 10/22/09

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	Y _d (lb/ft ³)	S (%)		Y _d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	Y _d (lb/ft ³)	S (%)	ϵ_{vs} (%)
129.97	2.79	5.83	11.7	108.9	60	0.52	109.1	-0.1	3.7	16.5	108.1	82	+0.9



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other: _____

Specimen Type: ☒ Circular

☐ Square

Sample Type: ☐ Undisturbed

☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.16 kg/cm²

0.52 kg/cm²

- kg/cm²

- kg/cm²

Inundated at 0.16 kg/cm²

Displacement Rate: 0.072 cm/hr

Peak Shear Strength

Y _h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.12	0.774	37.8°

End of Test Strength

Y _h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.57	0.639	32.6°

G_s : 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D 422	☒ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	129.97	Soil Passing (% dry wt. basis)	-	-	-	-	-	-	-	-	-	13.8

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); Y_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; Y_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

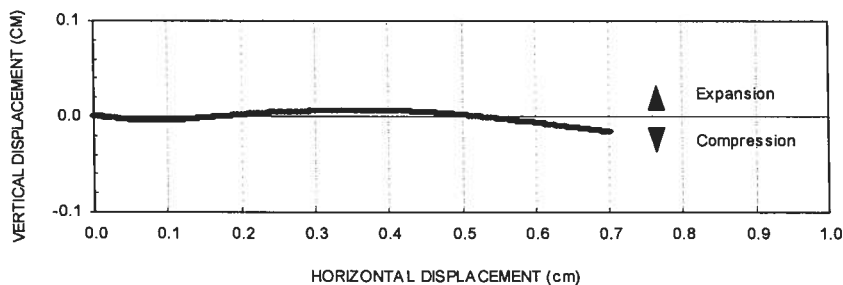
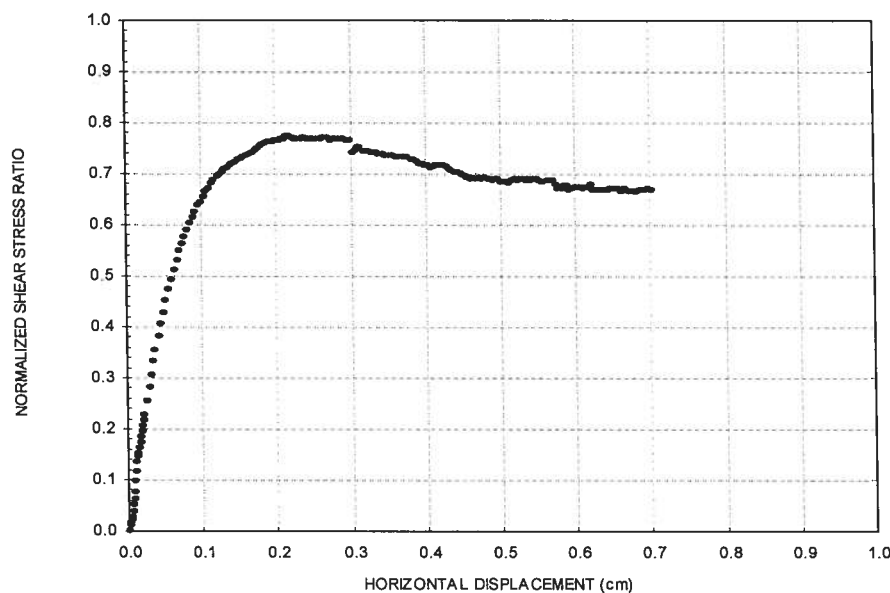
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/13/09
 DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 2 of 3
 BORING - SAMPLE -
 DEPTH - ft; - m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box2
 SAMPLE DESCRIPTION: Brown clayey sand, SC

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	y _d (lb/ft ³)	S (%)		y _d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	y _d (lb/ft ³)	S (%)	ϵ_{vs} (%)
129.88	2.79	5.83	11.7	108.9	60	1.00	110.3	-1.3	1.6	17.4	111.1	94	-0.6



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other:

Specimen Type: ☒ Circular

☐ Square

Sample Type: ☐ Undisturbed

☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.25 kg/cm²

0.50 kg/cm²

1.00 kg/cm²

- kg/cm²

Inundated at 0.25 kg/cm²

Displacement Rate: 0.072 cm/hr

Peak Shear Strength

y_n, cm

0.22

0.772

37.7°

End of Test Strength

y_n, cm

0.70

0.667

33.7°

G_s: 2.65

☒ Assumed

☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D 422 ☒ ASTM D 1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	129.88		Soil Passing (%, dry wt. basis)	-	-	-	-	-	-	-	-	-

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); y_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; y_n = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

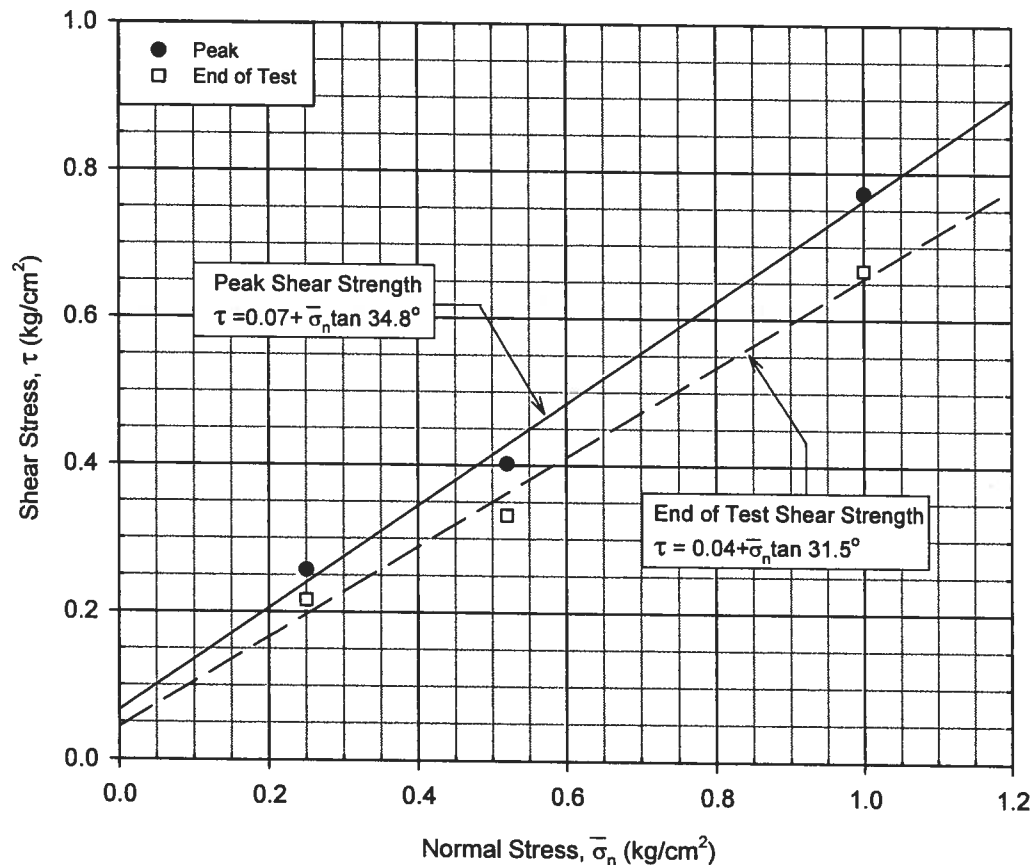
Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED DRAINED DIRECT SHEAR TEST
MOHR-COULOMB FAILURE ENVELOPE

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/12-13/09
 DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 2 of 3
 BORING - SAMPLE -
 DEPTH ☐ ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09177/Box2
 SAMPLE DESCRIPTION: Brown clayey sand, SC



Normal Stress $\bar{\sigma}_n$ (kg/cm ²)	Peak Shear Strength τ (kg/cm ²)	End of Test Shear Strength τ (kg/cm ²)
0.25	0.257	0.216
0.52	0.402	0.332
1.00	0.772	0.667

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Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

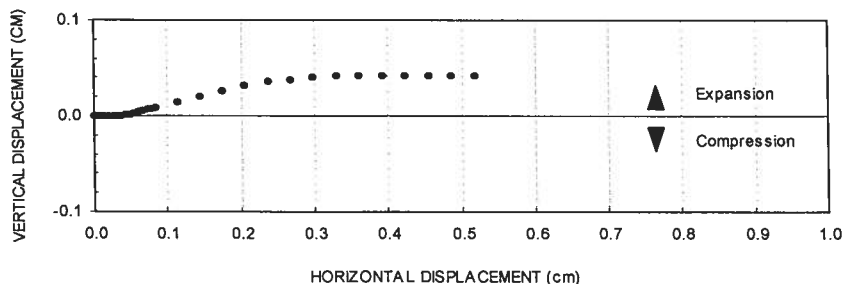
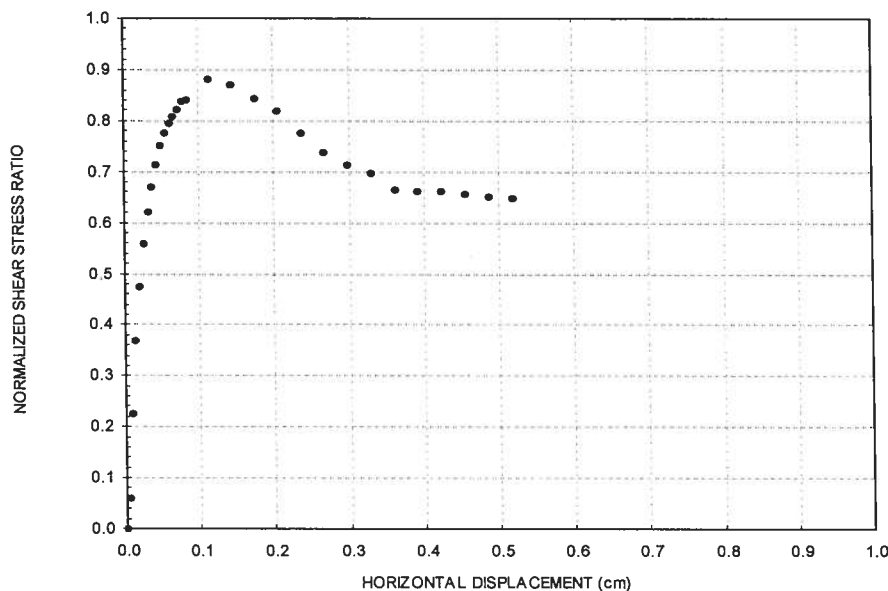
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

INCOMING SAMPLE NO.: Box 3 of 3
 BORING - SAMPLE
 DEPTH ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box3
 SAMPLE DESCRIPTION: Yellowish-brown medium to fine sand, SP

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/15/09
 DATE REPORTED: 10/22/09

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{vc} (%)	t_c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{vs} (%)
122.43	2.79	5.83	14.8	102.6	64	0.25	102.6	0.0	0.2	21.0	101.2	88	+1.5



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other:

Specimen Type: ☒ Circular
☐ Square
 Sample Type: ☐ Undisturbed
☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.16 kg/cm²
0.25 kg/cm²
 kg/cm²
 kg/cm²
 Inundated at 0.16 kg/cm²
 Displacement Rate: 0.37 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.11	0.881	41.4°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.52	0.648	33.0°

G_s : 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☒ ASTM D 422	☐ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	122.43	Soil Passing (% dry wt. basis)	100	100	99.6	94.4	69.4	38.8	17.0	5.1	2.6	2.0

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; γ_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: Date:

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY

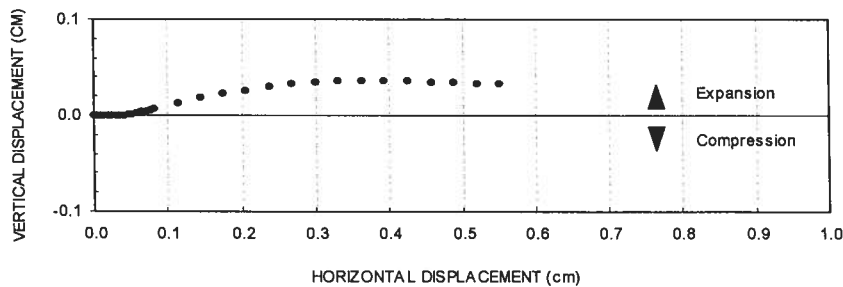
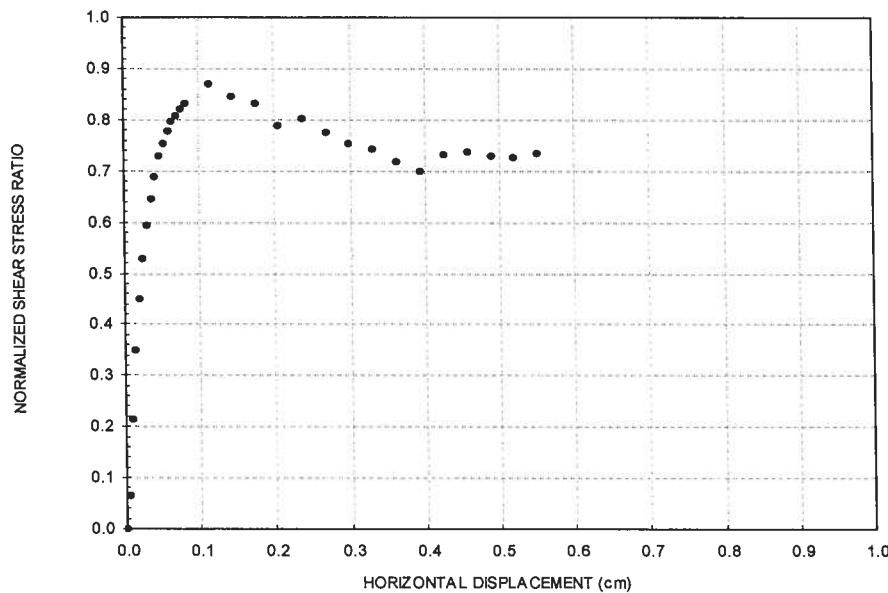
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE
 PROJECT: Princeville Flood Reduction Project
 FILE NO.: 09-0177

INCOMING SAMPLE NO.: Box 3 of 3
 BORING - - SAMPLE -
 DEPTH - ☐ ft; ☐ m
 LABORATORY IDENTIFICATION NO.: 09-0177/Box3
 SAMPLE DESCRIPTION: Yellowish-brown medium to fine sand, SP

DATE SAMPLE RECEIVED: 09/30/09
 DATE TEST SET-UP: 10/15/09
 DATE REPORTED: 10/22/09

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	γ_d (lb/ft ³)	S (%)		γ_d (lb/ft ³)	ϵ_{vc} (%)	t _c (hours)	w _c (%)	γ_d (lb/ft ³)	S (%)	ϵ_{vs} (%)
124.71	2.79	5.83	12.7	104.5	58	0.52	104.7	-0.1	1.7	18.5	103.4	82	+1.2



Test Methods & Procedures

☒ ASTM Standard D 3080

☐ Other: _____

Specimen Type: ☒ Circular
☐ Square
 Sample Type: ☐ Undisturbed
☒ Compacted

Test Conditions

Normal Stress Loading Sequence:

0.16 kg/cm²
0.52 kg/cm²
- kg/cm²
- kg/cm²
 Inundated at 0.16 kg/cm²
 Displacement Rate: 0.37 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.11	0.871	41.1°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\phi}_{ds}$
0.55	0.734	36.3°

G_s: 2.65 ☒ Assumed
☐ Measured

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☒ ASTM D 422	☐ ASTM D 1140-Method B		3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	124.71	Soil Passing (% dry wt. basis)	100	100	99.7	93.9	68.9	40.9	17.3	5.8	3.4	2.4

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Where: WDS = Specimen dry mass; H = Specimen height; D = Specimen diameter; w_c = Moisture content (ASTM D 2216); γ_d = Dry density; S = Saturation; G_s = Specific gravity; $\bar{\sigma}_n$ = Normal effective stress; ϵ_{vc} = Vertical strain during consolidation; ϵ_{vs} = Vertical strain during shear; t_c = Duration of final normal stress application prior to shear; γ_h = Horizontal displacement; τ = Shear stress; and $\bar{\phi}_{ds}$ = Effective friction angle assuming zero cohesion.

Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED DRAINED DIRECT SHEAR TEST REPORT

CLIENT: USACE

PROJECT: Princeville Flood Reduction Project

FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09

DATE TEST SET-UP: 10/15/09

DATE REPORTED: 10/22/09

INCOMING SAMPLE NO.: Box 3 of 3

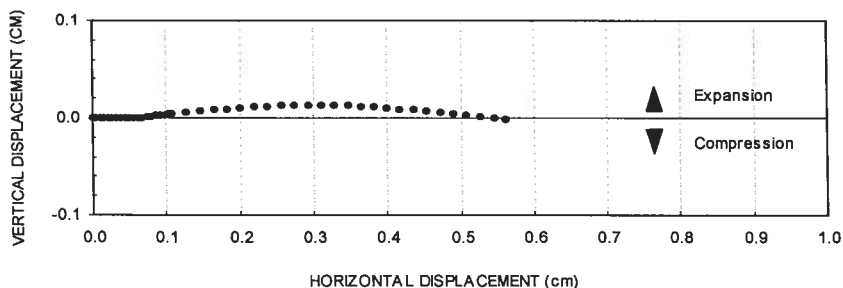
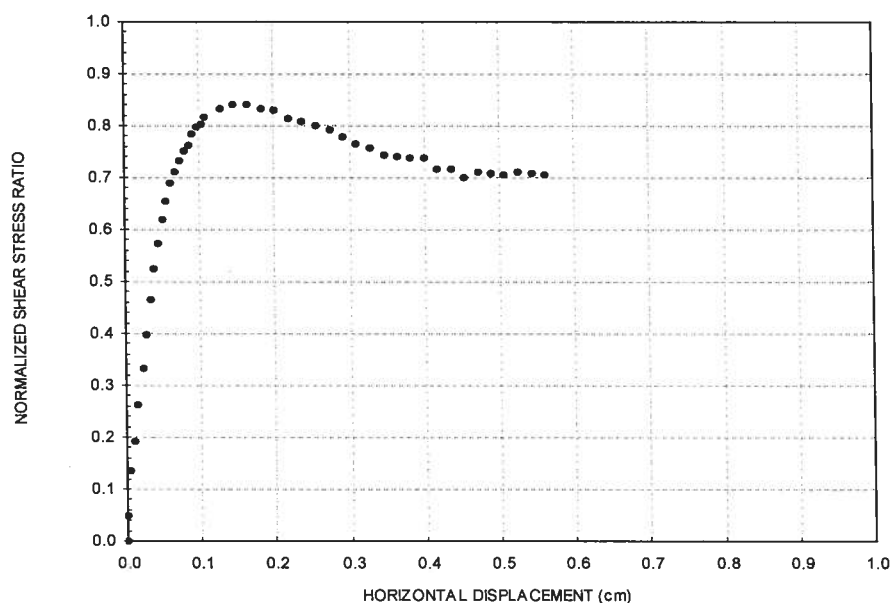
BORING - SAMPLE -

DEPTH - ☐ ft: ☐ m

LABORATORY IDENTIFICATION NO.: 09-0177/Box3

SAMPLE DESCRIPTION: Yellowish-brown medium to fine sand, SP

Initial Specimen Conditions						Normal Stress, $\bar{\sigma}_n$ (kg/cm ²)	Pre-Shear Conditions			Final Specimen Conditions			
WDS (g)	H (cm)	D (cm)	w _c (%)	Y _d (lb/ft ³)	S (%)		Y _d (lb/ft ³)	ε _{vc} (%)	t _c (hours)	w _c (%)	Y _d (lb/ft ³)	S (%)	ε _{vs} (%)
122.39	2.79	5.83	14.8	102.6	64	1.0	103.6	-1.0	2.0	19.4	103.7	86	-0.1



Test Methods & Procedures

☐ ASTM Standard D 3080

☐ Other:

Specimen Type: ☒ Circular

☐ **Square**

Sample Type: ☐ Equine ☐ Undisturbed

☒ **Compacted**

Test Conditions

Normal Stress Loading Sequence:

0.25 kg/cm²0.50 kg/cm²1.00 kg/cm²

-	kg/cm ²
---	--------------------

Inundated at 0.25 kg/cm²

Displacement Rate: 0.36 cm/hr

Peak Shear Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\varphi}_{ds}$
0.17	0.841	40.1°

End of Test Strength

γ_h , cm	$\tau/\bar{\sigma}_n$	$\bar{\varphi}_{ds}$
0.56	0.706	35.2°

G_s : 2.65 ☒ Assumed
☐ Measured

[illegible]

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Checked By: _____ Date: _____

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED DRAINED DIRECT SHEAR TEST
MOHR-COULOMB FAILURE ENVELOPE

CLIENT: USACE

PROJECT: Princeville Flood Reduction Project

FILE NO.: 09-0177

DATE SAMPLE RECEIVED: 09/30/09

DATE TEST SET-UP: 10/15/09

DATE REPORTED: 10/22/09

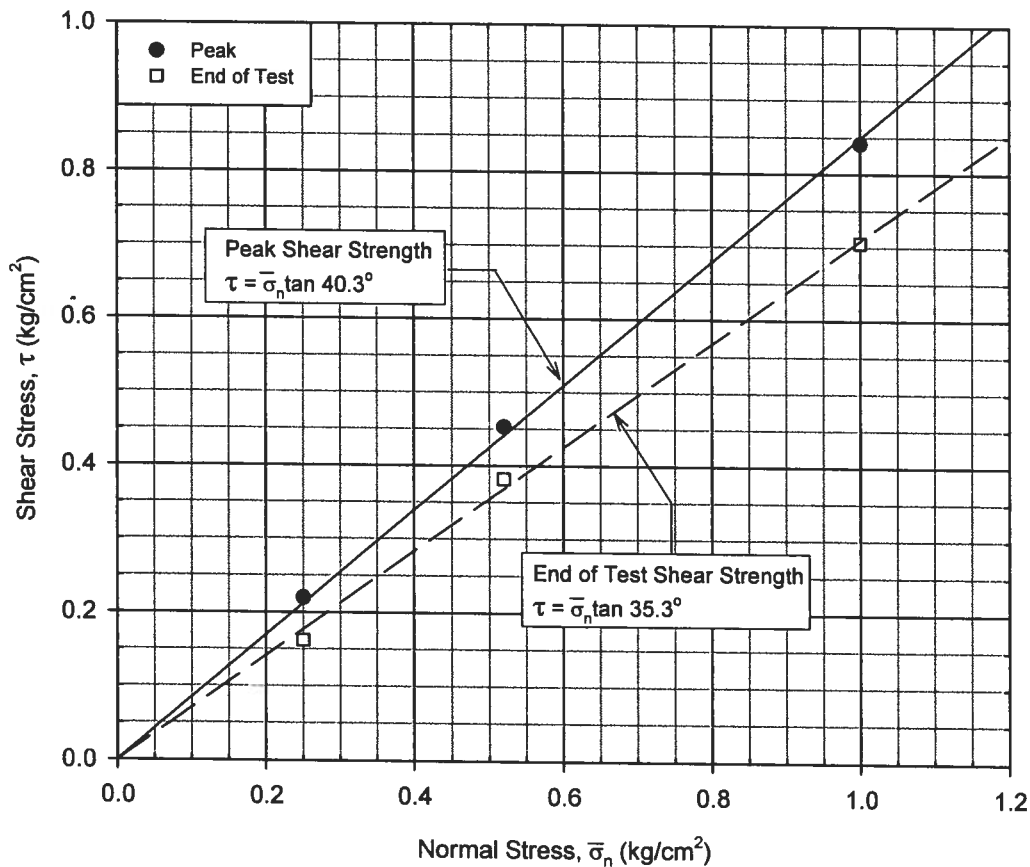
INCOMING SAMPLE NO.: Box 3 of 3

BORING - SAMPLE -

DEPTH - ☐ ft; ☐ m

LABORATORY IDENTIFICATION NO.: 09177/Box3

SAMPLE DESCRIPTION: Yellowish-brown medium to fine sand, SP



Normal Stress $\bar{\sigma}_n$ (kg/cm ²)	Peak Shear Strength τ (kg/cm ²)	End of Test Shear Strength τ (kg/cm ²)
0.25	0.220	0.162
0.52	0.453	0.382
1.00	0.841	0.706

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Checked By: _____ Date: _____